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SECTION I

INTRODUCTION

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I. INTRODUCTION

The Background Appendix is a compendium of supporting data for each issue addressed in the General Plan. Although located under separate cover, it is an adopted part of the General Plan Update.

The supporting data provided herein fulfills the statutory requirements and those set forth under the General Plan guidelines.

SECTION II

NATURAL HAZARDS

GEOLOGIC

GEOLOGIC

I. INTRODUCTION

It is only the works and activities of man that make geologic hazards a significant problem. Many hazards, such as landslides, erosion, and subsidence, are often accentuated by man's actions. As the population's numbers and activities grow, all geologic hazards increase. In San Bernardino County, these factors have significantly intensified over the past several years, increasing the need to comprehensively evaluate all applicable geologic hazards and their potential effect on existing and future development.

Hazards that are examined in this section include fault rupture and effects from earthshaking -- soil response, behavior of structures, liquefaction, earthquake influence on landsliding and effects on dams, lakes, and reservoirs. Tsunamis (tidal waves) are not a factor in San Bernardino as they are solely a coastal phenomenon. Non-seismic hazards considered are landslides (as a phenomenon not necessarily related to earthquakes), potential volcanic activity, ground subsidence and erosion.

A. Definitions

1. Seismic Hazards

In perspective, hazards related to earthquakes have not threatened life and property in San Bernardino County to as high a degree as certain other natural hazards: wildland fire, and flood, for instance. Nevertheless, large property losses and deaths can be attributed to seismic hazards.

The recent Whittier earthquake of October 1, 1987, and the even more devastating earthquake of February 9, 1971, in San Fernando Valley, are graphic reminders that earthquakes and the other hazards associated with them are a persistent phenomenon in the California environment.

But our modern population centers have not been tested by a truly large earthquake. The last great earthquake in California was the 1906, San Francisco event. The tests we have sustained (Whittier, 1987; Palm Springs, 1986; San Fernando, 1971; Long Beach, 1933) were comparatively small and localized.

However, they should serve as warnings of future, potentially much larger, destructive events. Seismic hazards include all those geologic and structural dangers posing a threat to man and the environment that result from earthquakes. The shaking and trembling of the earth that is generally referred to as an earthquake is the result of a release of energy in waves caused by displacement of the earth's crust. This slip can be caused by volcanic eruption, man-made explosion, or by the continued pressure of one plate against another. The later is the theory of "plate tectonics" (also known as the theory of continental drift). It holds that the earth's crust is composed of several inflexible plates floating on more fluid interior materials. Currents in the flexible material move the rigid plates into contact with one another, generating stress at the junctures. When the stress ceases to be absorbed any longer, slip or displacement occurs. (Figure 1) If an area of displacement is small and limited to the deeper part of the crust, the resulting earthquake will be small. However, if the break is large and extends to the surface, a devastating earthquake may result.

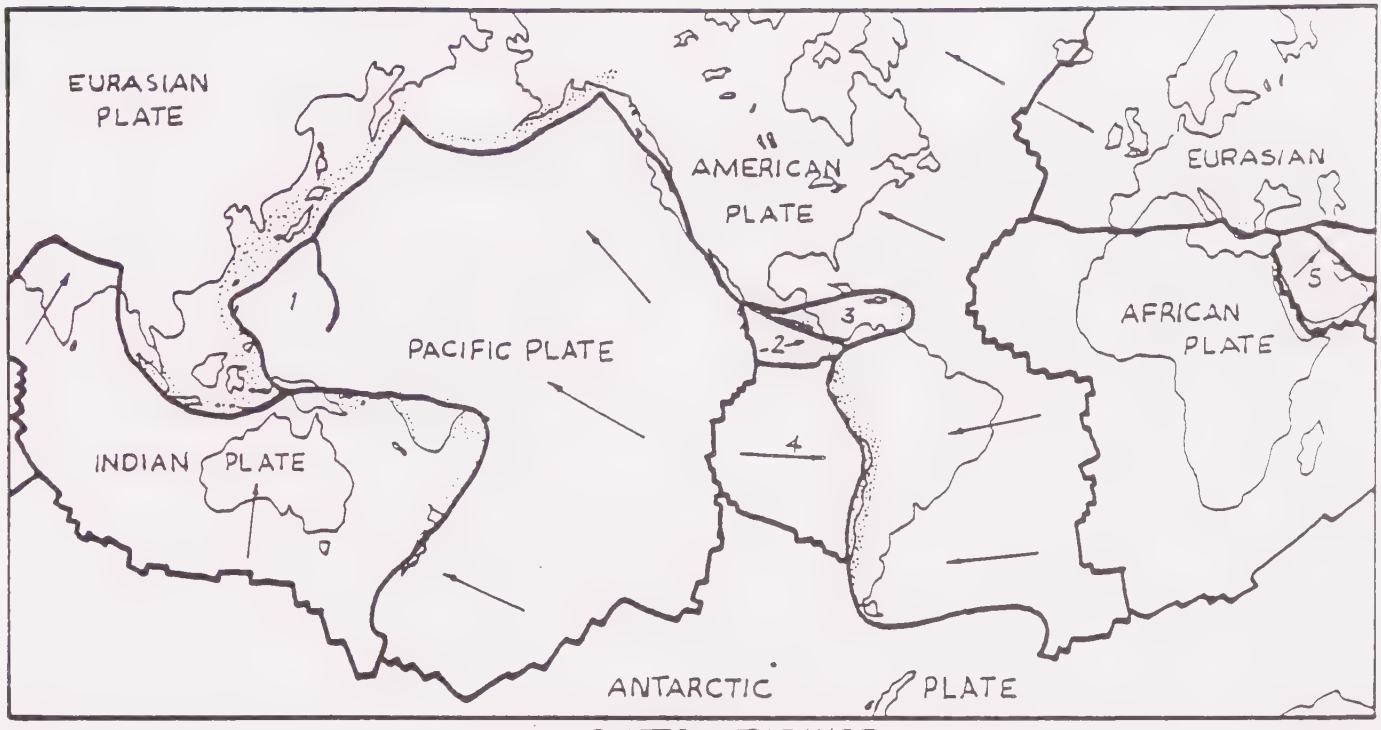
The accumulation of this energy and its subsequent release are cyclical and change from one part of the earth's crust to another, relying on variables such as the underlying geologic forces and existing weakness in or between the plates. As a result, prediction of seismic activity is difficult, increasing both the public's feelings of impotence and the need for adequate planning.

Breaks in the earth's surface caused by earthquakes are called faults and vary from the small breaks of an inch or so that can be seen in almost any road to much larger faults such as the infamous San Andreas Fault extending almost the entire length of California, including some of the most populated areas of San Bernardino County. Figure 2 shows types of fault movement.

Several terms are used to describe the location, size, and effects of an earthquake. A clear understanding of the meaning of these terms and their limitations is essential to an understanding of the results of this study.

FIGURE 1

Major Plates of the World

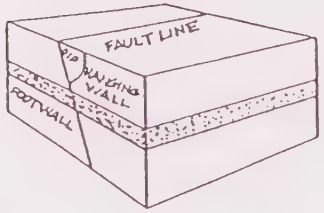


MAJOR PLATES OF THE WORLD

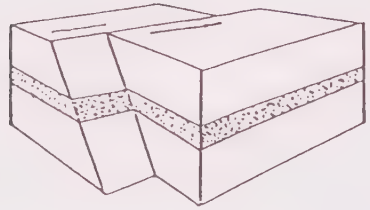
FIGURE 2

Types of Fault Movement

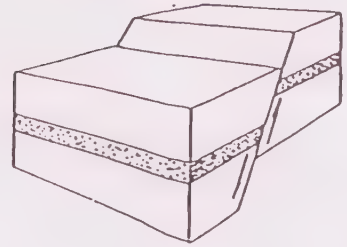
COMPONENTS



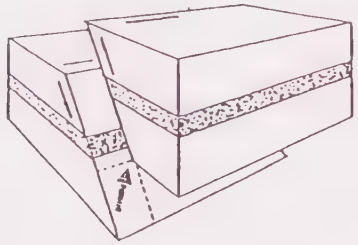
LEFT LATERAL FAULT(STRIKE-SLIP)



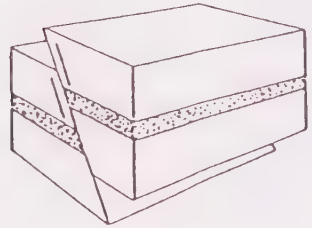
NORMAL FAULT



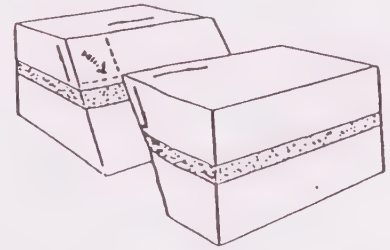
LEFT LATERAL REVERSE FAULT
(LEFT OBLIQUE REVERSE FAULT)



REVERSE FAULT



LEFT LATERAL NORMAL FAULT
(LEFT OBLIQUE NORMAL FAULT)



The location of an earthquake is generally given as its epicenter and is commonly described by geographic coordinates. This is a point on the earth's surface vertically above the hypocenter or focus of the quake. The latter is the point from which the shock waves first emanate. The vertical depth from the epicenter on the earth's surface to the hypocenter or focus is called the focal depth. Earthquakes in California, along the San Andreas and associated faults, have shallow focal depth. For most, the depth is less than 10 miles.

Earthquakes are classified in size by either or both intensity and magnitude. Magnitude of an earthquake, according to the Gutenberg-Richter Scale, is a measure of energy release at the focus of an earthquake as determined by the amplitudes produced on a seismogram. Technically, it is defined as the logarithm of the maximum amplitude as recorded on a standard seismograph at 100 kilometers (62 miles) from the epicenter. The important part of the definition is the logarithmic scale--it means that an increase of 1 on the scale represents a tenfold increase in the size of the earthquake record, and about a 32 times increase in the amount of energy released (Figures 3 & 4).

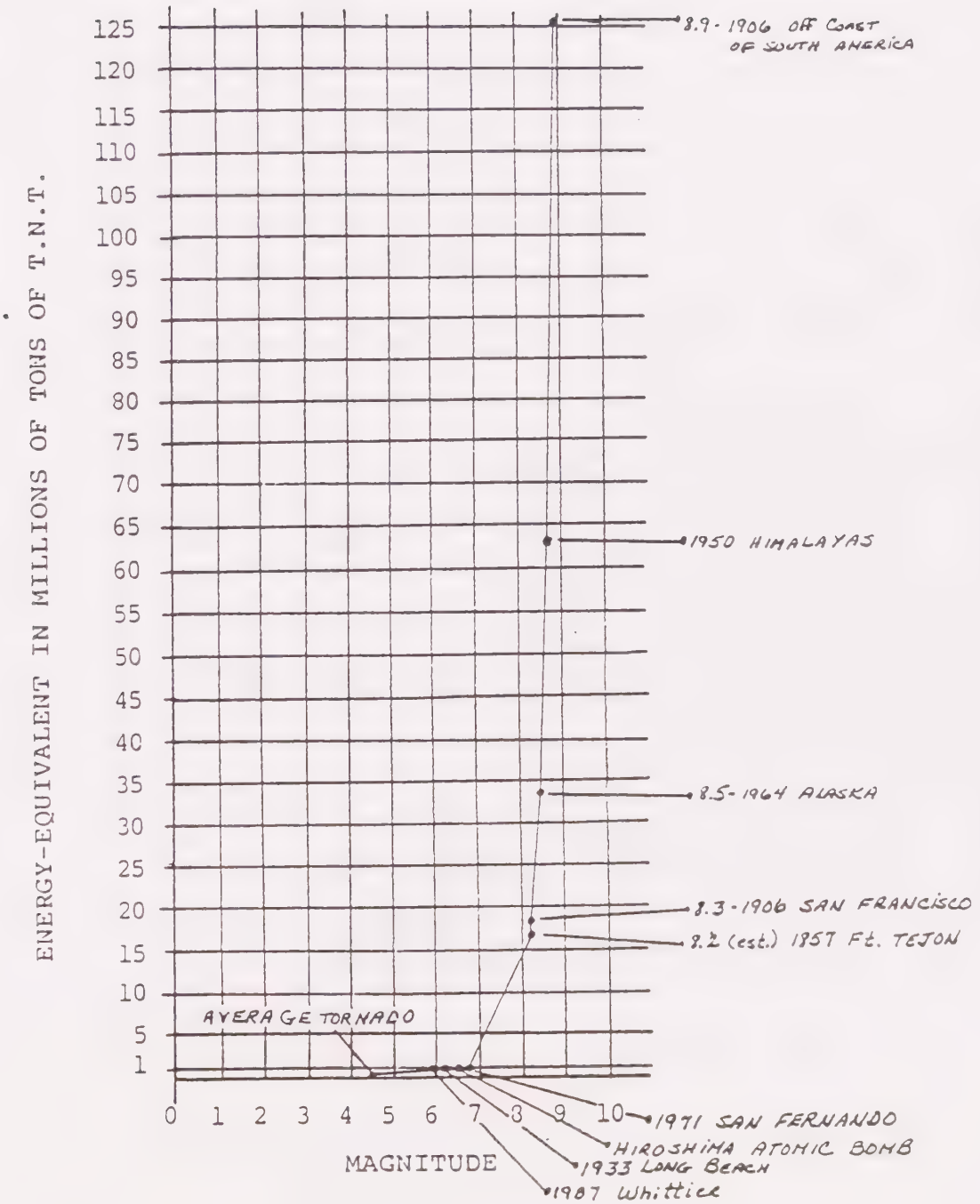
Though the Richter Scale allows comparison of earthquakes, it actually says little about potential damage. The Rossi-Forel and the more finely drawn Modified Mercalli (MM) Scales measure earthquake intensity (the severity of the ground's motion). All three scales are compared in Figure 5.

Earthquakes cause permanent changes in the earth's topography and have the potential to cause extensive damage to man and the physical, economic, and social environments. There are three basic destructive mechanisms triggered by earthquakes: breaking, shaking, and water damage.

Breaking can be divided into two classifications: actual fault rupture and another form of displacement, fault creep or (tectonic creep). Primary ground surface rupture associated with fault activity is relatively rare and may occur during a strong earthquake. Fault creep involves slow surface movement along a fault trace unaccompanied by earthquake. These primary surface displacements only occur along the fault line itself. Primary rupture should not be confused with cracks associated with ground failure,

ENERGIES OF EARTHQUAKES (MAGNITUDE 1.0-9.0)

Earthquake Magnitude	Approximately Earthquake Energy
1.0	6 ounces T.N.T.
1.5	2 pounds T.N.T.
2.0	13 pounds T.N.T.
2.5	63 pounds T.N.T.
3.0	397 pounds T.N.T.
3.5	1,990 pounds T.N.T.
4.0	6 tons T.N.T.
4.5	32 tons T.N.T.
5.0	199 tons T.N.T.
5.5	1,000 tons T.N.T.
6.0	6,270 tons T.N.T.
6.5	31,550 tons T.N.T.
7.0	100,000 tons T.N.T.
7.5	1,000,000 tons T.N.T.
8.0	6,270,000 tons T.N.T.
8.5	31,550,000 tons T.N.T.
9.0	199,000,000 tons T.N.T.


ENERGY-EQUIVALENT IN MILLIONS OF TONS OF T.N.T.
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
1
0 1 2 3 4 5 6 7 8 9 10
MAGNITUDE
8.9 - 1906 OFF COAST OF SOUTH AMERICA
1950 HIMALAYAS
8.5 - 1964 ALASKA
8.3 - 1906 SAN FRANCISCO
8.2 (est.) 1857 Ft. TEJON
AVERAGE TORNADO
1971 SAN FERNANDO
HIROSHIMA ATOMIC BOMB
1933 LONG BEACH
1987 Whittier

GENERAL RELATIONSHIPS BETWEEN GREATEST MEASURED INTENSITY AND MAGNITUDE

Richter Magnitude, M	Modified Mercalli Intensity Scale (1931) Wood and Newman	Rossi-Forel Intensity Scale (1883)
	I Detected only by sensitive instruments.	
	II Felt by a few persons at rest especially on upper floors; delicate suspended objects may swing.	M I The shock felt only by experienced observer under very favorable conditions.
M3	III Felt noticeably indoors, but not always recognized as a quake; standing autos rock slightly, vibration like passing truck.	II Felt by a few people at rest; recorded by several seismographs.
	IV Felt indoors by many, outdoors by a few; at night some awaken; dishes, windows, doors disturbed; motor cars rock noticeably.	III Felt by several people at rest; strong enough for the duration or direction to be appreciable.
M4	V Felt by most people; some breakage of dishes, windows, and plaster; disturbance of tall objects.	IV Felt by several people in motion; disturbance of moveable objects, crackling of floors.
	VI Felt by all; many frightened and run outdoors; falling plaster and chimneys; damage small.	V Felt generally by everyone; disturbances of furniture, ringing of some bells.
M5	VII Everybody runs outdoors; damage to buildings varies, depending on quality of construction; noticed by drivers of autos.	VI General awakening of those asleep; ringing of bells, swinging chandeliers, startled people run outdoors.
M6	III Panel walls thrown out of frames fall of walls, monuments, chimneys; sand and mud ejected; drivers of autos disturbed.	VII Overthrow of movable objects, fall of plaster, ringing of bells, panic with great damage to buildings.
	IX Buildings shifted off foundations; cracked, thrown out of plumb, ground cracked, underground pipes broken.	VIII Fall of chimneys; cracks in walls of buildings.
M7	X Most masonry and frame structures destroyed; ground cracked; rails bent; landslides.	IX Partial or total destruction of some buildings.
	XI New structures remain standing; bridges destroyed; fissures in ground; pipes broken; landslides, rails bent.	X Great disasters, ruins; disturbance of strata, fissures, rock falls, landslides; etc.
M8	XII Damage total; waves seen on ground surface; lines of sight and level distorted; objects thrown up into air.	M7 M8

*From Nuclear Reactors and Earthquakes, AEC TID7024.

liquefaction or lurching caused by shaking at locations away from the fault trace. Historically, damage due to primary ground surface rupture is insignificant when compared to damage from earthquake shaking because it is so localized. However, primary surface displacement will normally disrupt structures that cross the line of displacement. Therefore, it is inadvisable to place structures across known active faults.

Shaking usually encompasses several square miles and results in more extensive destruction of the structural environmental than any other earthquake hazard. Most earthquake-associated deaths result from structural failure. Structural hazards, in the broad sense, are the works of man. They cover community lifelines (transportation and utility systems) and buildings of all sorts, including dam and flood control works.

The severity of ground shaking is reliant upon the intensity of ground acceleration, underlying soil and geology that moderate the shaking, duration of motion and the type of building being shaken. Upon arrival of earthquake waves through the bedrock, overlying soil strata at a site act as a filter of the rock motions, either magnifying or diminishing their amplitudes. Assuming that valley fill, composed of stream-deposited alluvium (gravel, sand, silt, and clay) is loose and unconsolidated as compared to bedrock, the main variables are the thickness of alluvium, the relation of various beds in the alluvium, and the depth of the water table. Generally speaking, thick alluvium (more than 100 feet) will tend to amplify long period waves, and therefore, will be most important to the design of tall buildings (more than about 15 stories). On the other hand, thin alluvium will have a tendency to amplify short period waves, and therefore, will be more critical to shorter, more squatty structures.

Carrying the generalization a step further, tall buildings in the San Bernardino Valley where the alluvium is thicker than 100 feet, would be most affected by the long period waves that would most probably be generated from a major earthquake on the San Andreas fault located at some distance-- 25 to 50 miles away. Shorter building would be most affected on the edges of the valley where the alluvium is thinner by nearby moderate to strong earthquakes.

There are four major effects of earthquake shaking that cause the majority of structural failure:

1. Shaking which damages the structures directly

2. Shaking which causes soil failure beneath the foundation of a structure, thereby damaging the structure (liquefaction)

3. Shaking which causes the groundwater beneaththe foundation to shift resulting in the soil settling, thereby causing the structure to be damaged (subsidence)

4. Shaking which causes slope to lose strength (landslide)

Shaking alone can result in severe damage as structures are subjected to extreme horizontal movement they are not generally equipped to withstand. Earthquake energy is transmitted through various rock and soil layers as waves which cause a real displacement of the ground and any structures built upon it. These displacements, which occur in complicated patterns, cause corresponding displacements in the foundations of structures which in turn cause the entire structure to shake. If a structure is "in tune" with the arriving earthquake energy it will respond with severe shaking, provided that the energy input is great enough. If the parts of the structure are not well enough attached, they may separate. Permanent structural deformation might result even if the structure holds together.

The earthquake energy, although complex, is essentially a series of vibrations with different periods. Some vibrations will cancel out others and some will reinforce others. Thus, a structure is struck by a series of blows during an earthquake that come in some sort of basic cycle or rate, along with a variety of other blows that are less important. Any structure has a fundamental period of vibration; if struck by a blow it will sway or vibrate back and forth, perhaps at about one cycle per second for a building about 100 feet high. If the arriving earthquake energy also has a period of one cycle per second, this building will shake strongly because each arriving impulse adds to the previous energy. On the other hand, buildings not in tune with this particular earthquake energy will not be as likely to be damaged.

Some structures do a good job of absorbing earthquake energy. They are said to have a high damping. So, even if such a structure is in tune with arriving earthquake waves, it may not respond with great motion if it has good damping characteristics. Thus, the type of construction used for a building is important in its earthquake response. Some designs are simply more hazardous than others. Figure 6 shows the relative hazard in terms of susceptibility to damage for buildings not designed to be earthquake resistant. It is, therefore, applicable to older buildings in San Bernardino County, but not directly meaningful to buildings built in the last 40 or so years. The table does show that the wood-frame structure generally used for dwellings is relatively safe when compared to other types of construction, even if not particularly designed to be earthquake resistant. Traditional wood frame residences are most able to withstand the forces involved with modern, well-designed high rises giving relatively good performance. Unreinforced masonry structures are especially susceptible. New building standards have greatly improved earthquake resistance. However, in cases of severe earthquake "good performance" does not necessarily mean that the structure will remain habitable but merely that it won't collapse and that threat to life or of injury will be reduced.

Structures other than buildings are also an important consideration in seismic safety. Dams (which are discussed further below), utility installations, and transportation structures all have very important functions and potentially large consequences of failure.

Soil failure can also result in structural damage. One type of soil failure, liquefaction, can be especially devastating. Liquefaction occurs when ground shaking causes the overlying soil (especially sandy soils) to mix with water, generally high ground water (less than 50'), resulting in an unstable mass of a quicksand-like substance which undermines the very foundation of the structure. Results can range from settling of the structures to tilting or sliding off the foundation. (Figure 7).

Seismically-induced subsidence is a generally level, vertically downward movement caused by a lessening in soil water pressure, caused by fault-produced

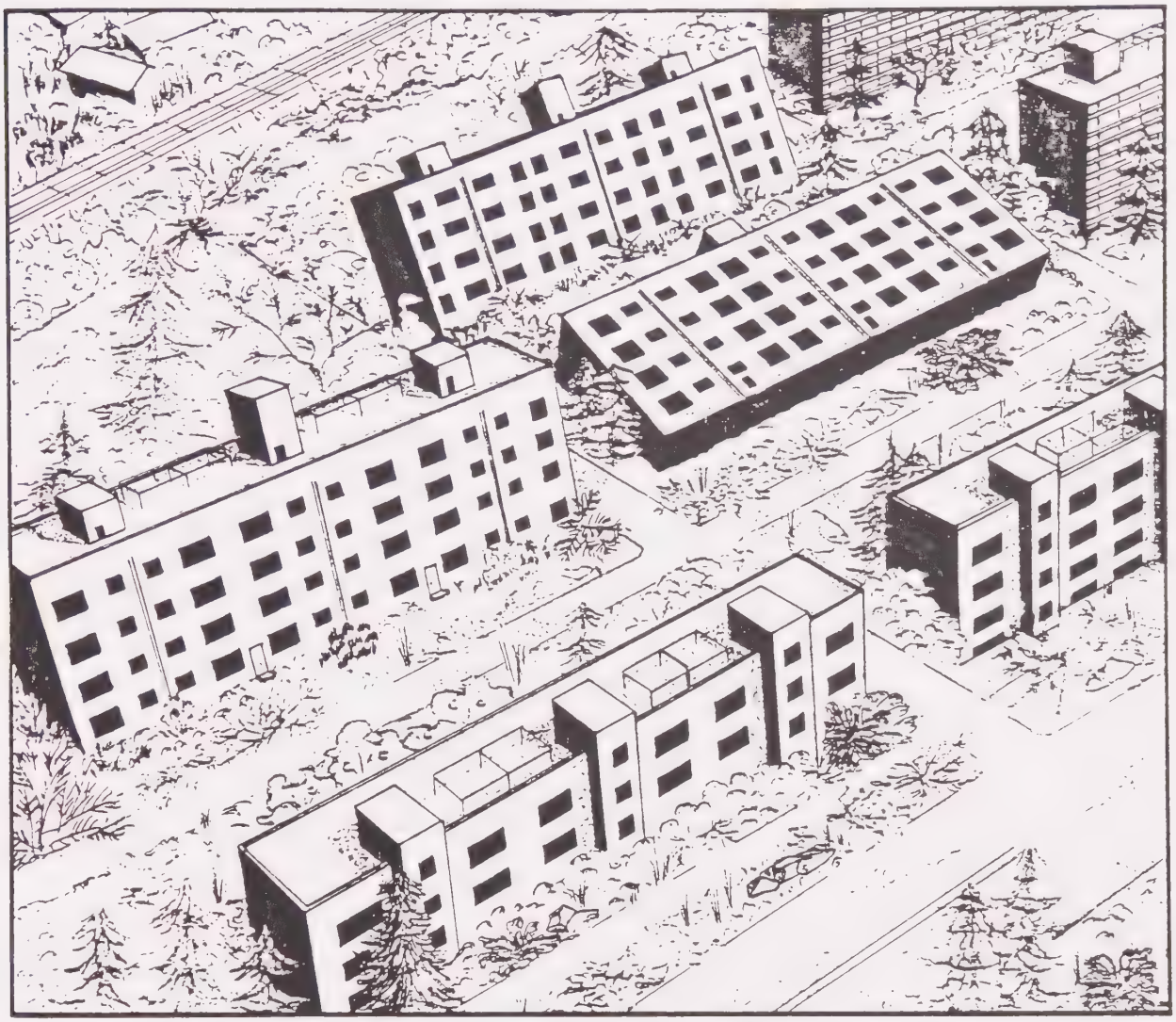
HAZARD COMPARISON OF NON-EARTHQUAKE-RESISTIVE BUILDINGS

NOTE: This table is intended for buildings not containing earthquake bracing, and in general, is applicable to most older construction. Unfavorable foundation conditions and/or dangerous roof tanks can increase the earthquake hazard greatly.

Simplified Description of Structural Type	Relative Damageability (In order of increasing susceptibility to damage)
Small wood-frame structures, i.e., dwellings not over 3000 sq. ft. and not over 3 stories	1
Single or multistory steel-frame buildings with concrete exterior walls, concrete floors, and concrete roof. Moderate wall openings	1.5
Single or multistory reinforced-concrete buildings with concrete exterior walls, concrete floors, and concrete roof. Moderate wall openings	2
Large area wood-frame buildings and other wood-frame buildings	3 to 4
Single or multistory steel-frame buildings with unreinforced masonry exterior wall panels; concrete floors and concrete roof	4
Single or multistory reinforced-concrete frame buildings with unreinforced masonry exterior wall panels, concrete floors and concrete roof	5
Reinforced concrete bearing walls with supported floors and roof of any materials (usually wood)	5
Buildings with unreinforced brick masonry having sandlime mortar; and with supported floors and roof of any materials (usually wood)	7 up
Bearing walls of unreinforced adobe, unreinforced hollow concrete block, or unreinforced hollow clay tile	Collapse hazards In moderate shocks

Source: Abridged from Pacific Fire Rating Bureau Tariff Rules.

FIGURE 7



Example of tilting and sinking of earthquake resistive structures built on unconsolidated water saturated sand and mud (liquefaction), Kawagishicho, Nigata, Japan 1964.

shifts in the ground water. In addition to destabilizing the structure's foundation, subsidence can also result in sufficient reductions in elevation to cause the building to be flooded by an adjacent body of water.

Earthquakes are known to trigger landslides. The relationship between earthquakes and landslides is not a direct cause and effect. The earthquake triggers landslides in an existing, potentially unstable area. Landslide susceptibility in the event of an earthquake would probably be proportionately increased assuming that an entire area was subjected to the same degree of seismic shaking. Local variation could be anticipated within a certain area of landslide susceptibility, depending on the location, and magnitude of the earthquake. Additional information on landslides is given in the next section on non-seismic hazards.

Water damage exacerbates all other hazards associated with seismic events. It has already been noted that subsidence can result in flooding by adjacent water bodies. Seiches **(say-shez)** and dam inundation are other potential sources of flooding associated with earthquakes.

Seiches are water surges (waves) within an enclosed body of water such as a lake, reservoir or even a swimming pool. These waves are generated primarily by earthquakes although landslides, strong winds and volcanic activity have also produced them. The action produced is similar to that of a pan of water tilted back and forth until it spills over the sides. Serious damage to development around the periphery of a lake is possible. The maximum height of seiche waves is dependent upon many variables, but they could be as high as ten feet or more. These waves would also increase pressures against dams impounding lakes and could even overtop the dam, which might lead to sudden failure resulting in torrential flooding of downstream areas. The variables relating to the height of seiche waves include the size, shape and depth of a reservoir, the propagation of earthquake waves with respect to the reservoir, and the proximity and size of the earthquake.

Dam inundation can also be a direct result of seismic activity. Ground shaking of dam walls and embankments can cause cracks, uneven settling and other weakening, permitting water pressure to break

the walls down. In addition, dams are frequently located on sandy soils which, when mixed with adjacent water, cause liquefaction, further degrading the integrity of the dam's structure. The failure of dams during earthquake could be independent of, or in combination with, seiching effects or landslide generated waves. Dam failure could be sudden, causing the rapid release of a large volume of water down confined stream channels, across roads, and into developed areas. The failure may be gradual, however, and at such a moderate rate that the resulting flow does not exceed the normal discharge rate of spillways or outlet facilities. The physical condition, design and construction adequacy, operating characteristics, past performance and probable mode of failure are considerations that must be studied for each major dam to assess the probable consequences of failure. During this century, at least thirty-four major dam failures occurred in the U.S. and Western Europe. Although not all of these were seismically induced, those that were flooded vast areas.

Secondary effects also occur in response to the primary effects discussed above. Damage to lifelines and damage to critical facilities at a time when their continued use is more important than ever can cause even more severe reactions. Damaged lifelines (see Figure 8) can result in disruption, loss of service, fire and sometimes explosion. Damage to critical facilities can result in loss of life, contamination of the environment and limited capacity when full service is requisite.

FIGURE 8. CLASSIFICATION OF LIFELINES

Energy	**Water**
Electricity	Potable
Liquid Fuel Gas	Sewage and Solid Waste
Transportation	**Communications**
Highway	Telephone and telegraph
Railway	Radio and television
Airport	Mail and press
Harbor	

An examination of the effects of the 6:00 am, February 9, 1971, San Fernando Valley earthquake

(6.5), though not as powerful as might be expected in San Bernardino County, nevertheless provides a graphic reminder of the disruption of the urban environment caused by a seismic event. The following urban components suffered substantial failure:

1. The San Fernando Dam. This dam had been determined to be unsafe at maximum levels before the earthquake and the operational level had been reduced. The dam failed through liquefaction of its center and it slumped 30 feet. Water impounded by the dam came within a few feet of overtopping the dam. Eighty thousand people were placed in danger. People downstream were evacuated until the level of the reservoir could be reduced.

2. Almost all large water storage tanks in the vicinity were toppled, ruptured or had their attachment lines severed.

3. The City of San Fernando water system was devastated. Wells were ruptured, reservoirs were cracked and the distribution system was so fractured it required rebuilding. Households went without water for up to four weeks.

4. Natural gas lines were ruptured. Many households were without gas for cooking and heating for many weeks.

5. Electrical lines were severed and the electrical system was devastated. The severed electrical lines caused fires. Some homes were lost from fire.

6. Telephone lines and plant facilities failed in many places obstructing fire reporting and emergency coordination.

7. Most sewer lines were inoperative.

8. Parts of the street system were impassable and some freeway overpasses, abutments, and embankments were destroyed.

"Damage to public facilities greatly endangered and inconvenienced inhabitants... and demonstrated the total reliance on these systems by people living in modern urban areas."

9. Damage to homes. This earthquake "damaged approximately 20,000 houses - destroying or nearly destroying 830 of them... A few were destroyed by fire. Structures overlying and immediately adjacent to zones of rupture associated with fault displacement were more greatly damaged than those a few blocks away. Single story residential structures generally fared better than two-story homes. Split level structures with a second story over the garage suffered the worst fate. Failures were generally related to the type of foundation materials..."

10. Damage to other buildings. Many major buildings including hospitals and large industrial buildings failed. Reinforced concrete did not perform as expected. Large public and private losses resulted from these failures and many lives were lost.

    Almost all elevators were out of service in San Fernando Valley.

As has been shown, earthquakes have the potential to release powerful forces affecting man and his environment drastically. These forces are sufficient to cause extensive damage on their own and when they come into contact with other natural or man-made features, that damage is multiplied many-fold.

2) Non-Seismic Geologic Hazards

Landslides and subsidence can be seismically-induced but are also significant non-seismic geologic threats in San Bernardino County. Volcanic activity and erosion are additional geologic hazards.

Landslides cost the United State over $1 billion annually. They are the costliest non-seismic geological hazards with losses in California estimated to be $9.9 billion between 1970 and the year 2000. The greatest hazard of landslides themselves is failure to recognize potential problem areas prior to urban development. Therefore, thorough examination, identification and mapping of landslides are vital.

Landslide is the downward and outward movement of slope-forming earth or rock materials. There are two components working on every slope. The first

is its strength or resistance to movement and the second is gravity or downward pull. When gravity exceeds strength through either an increase in gravity (extra weight) or decrease in strength (undermining), landslide occurs.

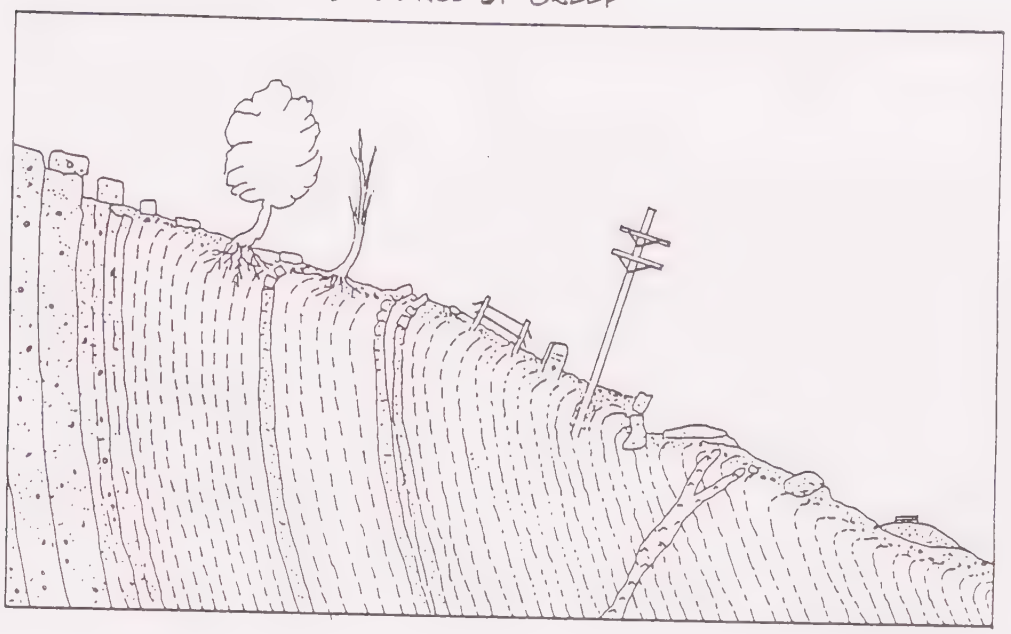
There are several causes of landslide. As has been discussed, earthquake is one cause. However, the most frequent cause of landslide is water. It both increases gravitational pressure by adding weight and saps strength by reducing the friction that holds the slope together. Erosion can also be a cause of landslide by undermining the strength of the slope. Human activities are major causes, too. Earthfill and construction add weight to a slope, and septic systems and irrigation of landscaping materials increase water saturation.

Landslides occur in many forms: Figure 9 illustrates many of them. Factors influencing landslides include soil and rock types, moisture, climate, rainfall intensity, geologic structures, and, as previously mentioned, human activity. These contributing factors may result in failure of old inactive landslide areas where soils are held in delicate equilibrium with the existing hillside environment and are especially subject to movement during wet cycles and earthquakes, or initiate new landslides. Movement may be rapid or slow ranging from nearly 40 mph to an almost imperceptible creep.

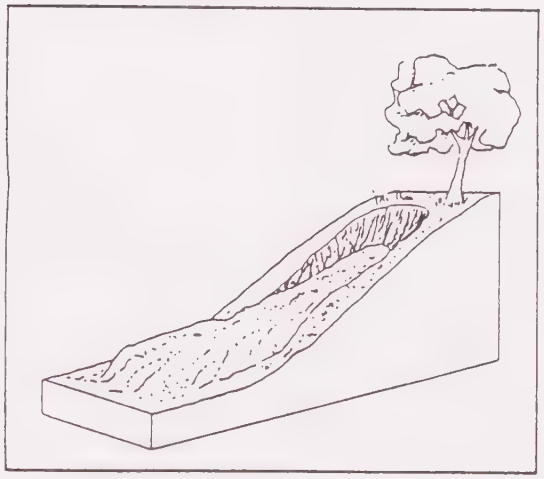
Landslides can be controlled by correcting many of the factors likely to cause them. According to a California Division of Mines and Geology Report on Geologic Hazards in Southwestern San Bernardino County (1976). "Once existing and potential landslide areas are recognized, most can be safely developed, avoided or removed. Landslide control may then become only a matter of engineering economics."

Subsidence, as previously cited, is the level, vertically downward movement caused by a lessening in soil water pressure. In addition to seismic sources, it can be caused by removal of large quantities of sub-surface liquids, especially oil and water, hydrocompaction or peat oxidation. Oil withdrawal and peat oxidation are not relevant in San Bernardino County subsidence activity.

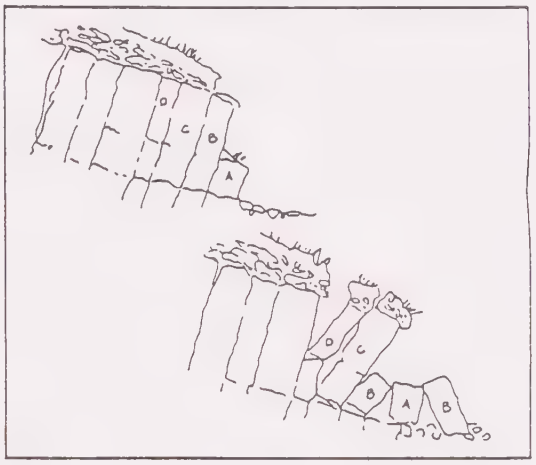
EVIDENCE OF CREEP



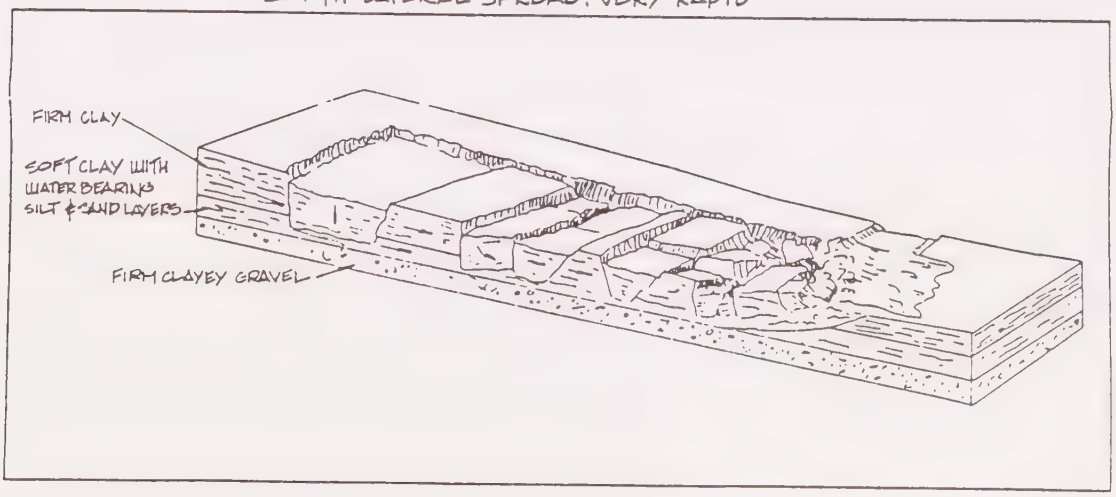
EARTHFLOW



ROCK TOPPLE



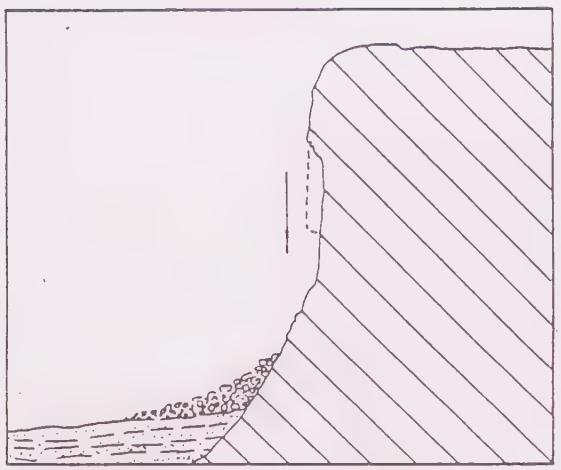
EARTH LATERAL SPREAD, VERY RAPID



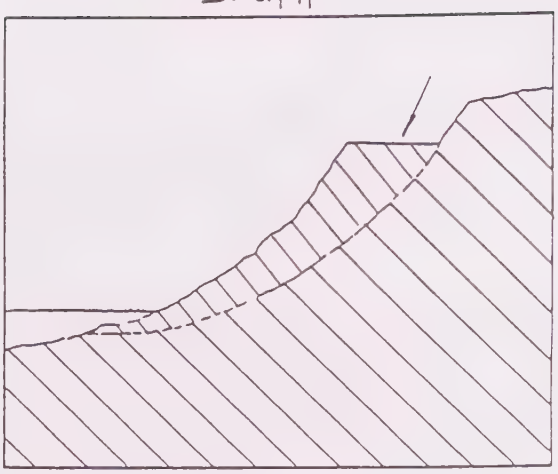
Types of Landslides

FIGURE 9a

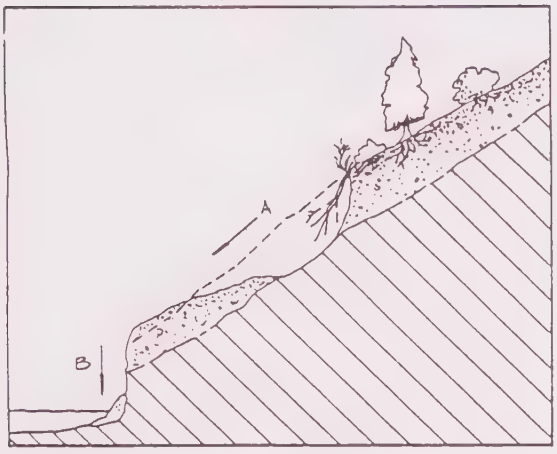
ROCKFALL



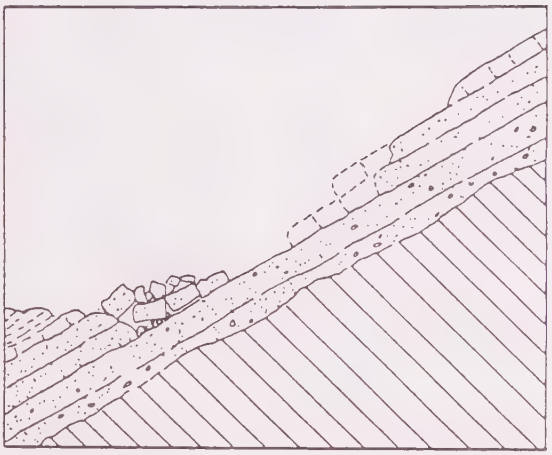
SLUMP



A. DEBRIS SLIDE
B. DEBRIS FALL



ROCKSLIDE



TERRACELIKE TERRAIN CAUSED BY A SERIES OF SLUMPS

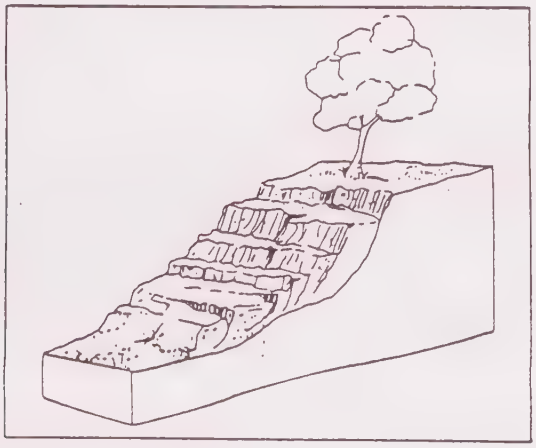


FIGURE 9b
Types of Landslides

Ground subsidence from groundwater withdrawal is a function of the amount of water withdrawn as well as soil particle size, shape and mineralogy, geochemistry of pore water and of water in contiguous aquifers, and compression. Ground surface effects of subsidence caused by groundwater withdrawal include loss of capacities of canals, drains, sewers and compaction of soils. Damage to water wells and associated piping has also been reported. Compaction of soils at depth can cause collapsed and telescoped well casings or protrusion above the ground surface casings. Because the subsidence is gradual, damage usually also occurs gradually, but can be highly significant over a period of years. It may be mitigated by stopping the withdrawal of water, restoring aquifer pressure by slowing withdrawal or repressuring with fluid injection.

Hydrocompaction is common in desert environments and occurs above the zone of saturation. It transpires when certain porous or open textured soils, usually fine-grained, such as mudflows are saturated with water for the first time since they were deposited. They then lose their strength and, consolidated, sink under their own weight. Mudflows that originate during periods of heavy rainfall on alluvial fans are particularly susceptible to hydrocompaction. The mudflow becomes increasingly dry both through evaporation and absorbsion of the water into surrounding dry soils, resulting in low density, open-textured characteristics. Hydrocompaction subsidence is usually undetected until new lands are brought under irrigation. In the San Joaquin Valley, this phenomenon has damaged ditches, roads, pipelines and structures. One method to remedy hydrocompaction problems is to pond water to saturate and consolidate the material until all subsidence has taken place before a new structure or facility is constructed.

Erosion is a composite of all processes by which earth or rock materials are loosened or suspended and moved from place to place. It generally involves two problems--the removal of material from one site and its deposition at another site. The removal of material by sheet, gully or streambank erosion and wind erosion can be damaging to roads and other structures. Damage through deposition could affect rivers, reservoirs, drainage structures and development on flood plains. According to Norman Beal of the U.S. Soil

Conservation Service "as much as two billion tons of sediment is deposited every year in the nation's stream systems... That makes sediment the country's greatest single water pollutant by volume".

Natural erosion activity depends on the length and steepness of slopes, amount and intensity of rainfall, type of cover and soil types. In the desert area, wind erosion is a common type of erosion and is evident from the scattered dune sand deposits. Some earth materials such as loose, fine-grained soils are more susceptible to erosion by both wind and water. Although the desert area receives less than 10 inches precipitation per year, the rainfall comes in high intensity storms, producing local flash floods. If the surface receives more water than what can infiltrate into the ground, the excess moves downslope as sheet flow, forming tiny rivulets and, in turn, eroding gullies. However, only about 30% of all erosion is due to natural causes. The remaining 70% is the result of human activity. Erosion prevention measures are commonly covered in erosion and sediment control plans and grading plans including recommended slope drainage provisions, slope protection and planting. In developed areas, the problems of erosion can be effectively controlled with proper maintenance.

Volcanic activity is simply the geologic phenomenon whereby a vent, or opening of the earth's crust releases molten or hot rock and steam sometimes resulting in a hill or mountain composed wholly or in part of the ejected material. The eruption on May 18, 1980, of the dormant Mt. St. Helen's volcano in Washington State (60 dead, $2.7 billion in damages) alerted planners to the necessity of evaluation of the probability of volcanic activity within their planning areas.

II. CURRENT STATUS

A. Sources of Data and Analysis

Digitized mapping of seismic hazards was undertaken to map all known hazard areas. This mapping is considered to be a critical part of the land use analysis required to mitigate the risks posed by seismic hazards. Once the hazardous areas of the County are located, growth can be guided away from these dangerous sites, new structures can be built to sufficiently high earthquake-resistant

standards and existing buildings can be strengthened to make them more earthquake resistant. Overlay maps are being generated for the following seismic hazards: faulting, liquefaction susceptibility and dam inundation.

Although shaking intensity projections are frequently mapped, at the recommendation of the County Geotechnical Committee this will not be done for San Bernardino County. Such an evaluation involves variables that must be assessed on a project by project basis. Some of these variables were discussed in the section describing earthquake intensity. It is evident from this information that the prediction of shaking intensity is an extremely complex one that should be obtained through site specific analysis.

The Alquist Priolo Special Studies Zone Act (APSSZA) forms the basis of the mapping of faults. The APSSZA was enacted in December 22, 1972 and went into effect March 7, 1973, and provides for "the adoption and administration of zoning laws, ordinances, rules and regulations by cities and counties in implementation of the general plan". (Public Resource Code Section 2621.5). The purpose of the APSSZA is to prohibit the location of most structures for human occupancy across the traces of active faults and to mitigate, thereby, the hazard of fault rupture. As a result of the Act, the State Geologist was required to identify active faults in California and designate "special studies zones" 500 feet from major active faults and 200-300 feet from well-defined minor faults. "Active fault" for the purpose of the APSSZA was defined as one that has had activity within the last 11,000 years. The State Geologist's identification is an ongoing process. The County has digitized all those active faults previously identified and, in addition, has included those added by the State Geologist to become effective in March of 1988.

Liquefaction susceptibility maps were digitized for the Valley areas from maps generated by the California Division of Mines and Geology in 1986. Additional examination throughout the County would involve an analysis of depth to groundwater studies, especially in comparison with sandy soil types.

Dam inundation maps were made available by the County Office of Emergency Services and Flood Control District. The Army Crops of Engineers, State Department of Water Resources, Metropolitan Water District, Bureau of Reclamation, and CM Engineering Associates were sources

for various areas. Dams mapped include Big Bear, Little Mountain, Small Canyon, San Antonio, Lake Gregory, Lake Arrowhead, Mohave River Forks, Cedar Springs, Mohave River, Gene Wash/Copper Basin, and Parker Dams. Alta Loma, Wiggins and Cucamonga Percolation Basins are also included. The effect of digitizing these maps in San Bernardino County is to standardize the criteria and siting of this seismic hazard for land use purposes.

B. Existing Condition/Trends

San Bernardino County is historically an area of high seismic activity. There is considerable scientific evidence to assume that it will continue to be. The entire County is criss-crossed by faults, including one of the longest in the world (San Andreas) and most active in California (San Jacinto).

Probably the most important historical earthquake with respect to San Bernardino County, was the Fort Tejon Earthquake. This shock was one of the greatest which occurred in California. Ground rupture was reported from Cholame on the north to at least as far south as the Cajon Pass and probably as far as the San Gorgonio Pass. This earthquake must have subjected southwestern San Bernardino County to severe shaking, equivalent to at least Intensity VII. Other important earthquakes affecting San Bernardino County are examined in Figure 11.

During the last 1200 years, at least 8 major earthquakes have occurred on the segment of the San Andreas from just south of Wrightwood extending north 200 miles. These seismic events were 140 years apart on the average with the last dated 1857. In any given year there is a 2-5% chance of another major earthquake (8.3 magnitude) occurring along this segment of the San Andreas Fault with an over 50% chance of the event within 20-30 years. According to the FEMA Report of 1980, a devastating seismic event is expected to produce strong ground shaking (above the threshold for causing damage) which would create a swath of destruction "about 250 miles long and 100 miles wide and include almost all of Los Angeles-San Bernardino Metropolitan area". Estimates range from 3,000 - 14,000 fatalities with over $20 billion in damages. The FEMA Report goes on to state, "Because of the large concentra-tion of population and industry the impacts of such an earthquake would surpass those of any natural disaster thus far experienced by the nation. Indeed, the United States has not suffered any disaster of this magnitude on its own territory since the Civil War". According to the

FIGURE 10

MAJOR FAULTS IN SAN BERNARDINO COUNTY

FAULT	MAXIMUM CREDIBLE MAGNITUDE	POPULATION CENTER OF COUNTY AFFECTED	LENGTH (MILES)
Calico-Mesquite	6.9	Twentynine Palms	80
Camp Rock-Emerson	7.1	Victorville-Barstow	90
Cucamonga	6.5	West end of San Bernardino Valley	55
Elsinore-Whittier	7.5	West end of San Bernardino Valley	55
Garlock	7.0	primarily uninhabited area	140
Helendale	6.5	Victorville-Barstow	55
Lockhart-Lenwood	7.0	Victorville-Barstow	85
Ludlow	6.1	primarily uninhabited area	45
Manix	6.4	primarily uninhabited area	14
Pinto Mountain	6.5	Morongo Valley through to Twentynine Palms	55
Pisgah	6.7	primarily uninhabited area	48
San Andreas	8.3	San Bernardino Valley, Mountain Areas, and Victorville Area	600
San Jacinto	7.5	San Bernardino Valley	275

FIGURE 11

SIGNIFICANT EARTHQUAKES AFFECTING SAN BERNARDINO COUNTY

DATE	EPICENTER	MAGNITUDE	INTENSITY *	FAULT ZONE	DAMAGE IN SAN BERNARDINO COUNTY
Jan. 9, 1857	Fort Tejon	8 + (est.)	X - XI	San Andreas	possible fault breakage on San Andreas and San Jacinto faults
July 22, 1899	Cajon Pass	?	VIII	San Andreas	San Bernardino, Highland and Patton. Lytle Creek Canyon blocked by slides. Cajon Pass filled w/debris for 20,000 ft.
Sept. 19, 1907	Cherry Valley Area	?	VII	San Andreas	San Bernardino and Redlands
April 12, 1918	Riverside County	6.8	VI - VII	San Jacinto	San Bernardino, Redlands (150,000 sq. mi.)
July 22, 1923	San Bernardino Vly.	6.3	VII	San Jacinto	San Bernardino schools, masonry buildings and chimneys (70,000 sq. mi.)
April 10, 1947	East of Barstow	6.4	VII	Manix	Highways and Mojave River Banks cracked in area. Victorville Lake Arrowhead (75,000 sq. mi.)
Dec. 4, 1948	Desert Hot Springs	6.5	VII	Mission Creek branch of San Andreas	San Bernardino Mtns. landslides, Big Bear City, San Bernardino (65,000 sq. mi.)
July 21, 1952	Wheeler Ridge (South of Bakersfield)	7.7	XI	White Wolf	Arrowhead, Big Bear City, San Bernardino
April 15, 1965	San Bernardino Vly.	4.5	VI	San Andreas	San Bernardino Valley
April 8, 1968	San Bernardino Mtn. (East end)	6.4	VI	San Andreas	San Bernardino Valley
Sept. 12, 1970		5.4	VII	San Andreas or San Jacinto	San Bernardino Valley
Feb. 9, 1971	San Fernando	6.4	VIII - XI	San Fernando (same fault system as Cucamonga)	Water Tower Collapse at Yorba-Slaughter Ranch. Damage to plaster in San Bernardino and Colton

* Inten[redacted] in San Bernardino Valley (Modified Mercalli Sca[redacted]

San Bernardino SCEPP Task Force energy released by a magnitude 8.3 earthquake is roughly equivalent to that released by exploding a 15 megaton hydrogen bomb. However, the San Andreas is not the only fault to affect San Bernardino County. The San Jacinto fault is considered to be the most active fault in Southern California. It has been 64 years since a significant earthquake occurred in the San Bernardino region, and it appears that a moderate to large earthquake may be overdue somewhere along the northern segment of the San Jacinto fault Zone.

In the event of such a devastating earthquake, San Bernardino County could be subjected to damage from all the seismic hazards delineated earlier.

However, neither the October 1, 1987, Whittier earthquake (7 dead, $213 million damage nor the May 1983 Coalinga earthquake (more than $3 billion damages) occurred on a known fault. Jerry Eaton, a geologist with the U.S.G.S. in Menlo Park believes that the entire State may "harbor an unexpected number of invisible, deeply buried, unstable geologic structures also capable of generating an earthquake." " An earthquake of about magnitude 6 can happen anywhere in Southern California without our expecting it," adds U.S.G.S. geophysicist, Douglas Given.

Fault Rupture and Creep

Rupture constitutes a significant hazard. Historic ground surface rupture in San Bernardino County is known only on the San Andreas and Manix faults. However, a severe earthquake on any of the major faults could produce rupture. Although the provisions of the Alquist Priolo Special Studies Zone Act have been enforced since it was adopted by the County, extensive development straddling faults occurred prior to that time. An examination of the fault maps shows where this conflict could occur.

A number of very important facilities have been constructed, possibly needlessly, across the San Jacinto fault in highly populated city areas. The Guthrie interchange, (the intersection of the 10 and 215 interstate highways, major routes through San Bernardino) sits astride the fault zone. The Santa Ana Pipeline, the arterial of the California Aqueduct through San Bernardino, crosses the fault three times. San Bernardino Valley College also straddles that fault. Surveys indicate that this major fault is undergoing minor creep in the Colton area.

The entire San Bernardino-Chino Valley areas is subject to a greater than ordinary hazard from the effects of shaking due to earthquake. Communities in the valley area are crossed by the San Andreas, San Jacinto, Cucamonga faults, and the Chino-Corona segment of the Elsinore-Whittier fault, all of which are known to be active. While mapping for shaking intensity is not being done for this project as previously mentioned, earlier studies indicate that damage from shaking composes the most significant seismic risk to Valley residents.

Liquefaction occurs where the groundwater is shallow (less than 50 feet). In the mountain and desert regions of San Bernardino County, local areas of shallow groundwater occur in alluvial materials and beneath dry lake beds.

Although ground-water levels are high beneath many dry lake beds, much of the underlying soil is clay which is ordinarily not subject to liquefaction. The location of the general areas of potential liquefaction in alluvial materials for this study was primarily based on the location of known shallow groundwater areas. Areas of potential liquefaction in the desert include:

(a) The Mojave River and Colorado River alluvial areas.

(b) Areas adjacent to certain faults that form groundwater barriers such as local areas southwest of the Calico fault near Barstow, southwest of the Helendale fault in Lucerne Valley, and southwest of the Lockhart fault west of Barstow.

(c) Dry lakes including the China Lake, Searles Lake, Cadiz Lake, Danby Lake, Bristol Lake, Troy Lake, and Silver Lake areas. Shallow groundwater (less than 10) feet has been recorded in these areas.

(d) Other local areas such as the Mojave Wash near Crucero, and the Baker areas south of Silver Lake.

(e) In the mountains a small area between Big Bear Lake and Erwin Lake has especially high groundwater.

(f) The general areas of potential liquefaction serve only as a guide for more detailed investigative work. Not all alluvial material is susceptible to liquefaction and the alluvium may vary drastically over a short distance in one area; therefore, areas of potential liquefaction in the above list may include local areas not susceptible to liquefaction. Also, groundwater levels may fluctuate significantly

on a seasonal basis. Temporary saturation of near surface granular material by ponding could create temporary areas of potential liquefaction in the event of an earthquake.

In the valley area somewhat more information is available concerning liquefaction. In addition, the consequences of liquefaction in valley alluvium is much greater than in other parts of the County. Areas most susceptible to liquefaction correspond to the areas of marsh land and high ground water which were present in the late 1800s Groundwater pumping has since lowered ground water levels, but water levels are still relatively high in the areas of previous high levels, or on the order of 50 feet. Further, seasonal fluctuations are sometimes marked, up to 40 feet. Decisions to operate the ground water basin at relatively high levels, if new sources of water such as California Aqueduct water become available for recharge, can increase the liquefaction potential.

The two areas of relatively high potential for liquefaction in the valley area are: the south central areas of the City of San Benardino and adjoining communities, an area of about 30 square miles; and the southwest part of Chino and adjacent portions of the southwest corner of the valley, an area of about 20 square miles.

Subsidence

The extensive mining of water has lowered groundwater levels throughout the Valley and initiated subsidence in areas of most intense pumping. For instance, sizeable marshes, located near the Santa Ana River in the south-central portion of the City of San Bernardino and northeast of Chino Hills, existed in the late 1800s, and have since disappeared as a result of lowering water levels. In a 1971 study by Lofgren found at least one foot of subsidence in an artesian area immediately north of Loma Linda with a potential for 5.8 feet of subsidence. The Upland-Ontario area could have from 0.8 to 1.5 feet of subsidence. As a result, local water agencies have elected to spread enough imported water to halt or at least impede further subsidence. As mentioned above, however, these areas are the most susceptible to the effects of liquefaction of foundation soils during earthquake shaking. There is insufficient data to provide the precise delineation of subsidence problems. Groundwater studies (currently being conducted by Environmental Health Services), surveys and field investigation are required for specific identification of hazardous subsidence areas.

In subsiding areas, shaking during an earthquake would probably result in lurch cracks and acceleration of the consolidation process (USGS, Special Report 113).

Landslide

Portions of the San Bernardino and San Gabriel Mountains have a high potential for landslides, particularly during earthquakes. Of particular concern in the valley is the Chino Hills area. In the mountains, the Wrightwood landslide, located on the San Andreas fault is of primary concern as are any other areas where high landslide susceptibility combines with proximity to high seismic activity. However, even low susceptibility areas in proximity to seismic activity are potentially hazardous. For instance, a normally low susceptibility in the desert, (steep slopes underlain by fractured, jointed or faulted rocks in both natural slopes or artificial cut slopes) and close to the earthquake source could be highly susceptible to rockfalls and rolling boulders during a moderate to strong earthquake. The 1947, magnitude 6.4, Manix earthquake triggered landslides that damaged the railroad right-of-way along Afton Canyon, east of Manix. In addition, local areas in the San Bernardino Mountains, which are classified as moderately susceptible, could be subject to numerous slides particularly if the earthquake occurred when the ground was saturated. Under saturated ground conditions, flow landslides associated with liquefaction could occur, even along slightly sloping ground (15° or less). Additional information on landslides is given in the next section on non-seismic geologic hazards.

Seiche

Seiche action in lakes and reservoirs is not well understood, nor are there many examples of disastrous results of seiche. Nevertheless, as development encroaches to the edges of large reservoirs in the County a definite hazard may exist. Areas where development is most significant are adjacent to Big Bear Lake, Lake Arrowhead and Lake Havasu. More detailed analysis should be made to determine the degree of hazard. However, consideration of seiching affect should be given to development adjacent to any large body of water in the County. Waves in reservoirs due to landsliding into the reservoir is a much more common occurrence than seiche waves due to earthquakes. However, in general, rim stability of reservoirs in San Bernardino County is good.

Dam Inundation

Many of the dams within the County are either dry most of the year, as in the case of Flood Control District dams or they are too small to have inundation studies. A list of dams in the County is found in Figure 12.

The dams that could have potentially hazardous effects in the County are in the mountain areas in the southwestern part of the County and along the Colorado River in the eastern part of the County. The bodies of water impounded by these major dams could have seiching effects, and the areas downstream of these dams could be subject to devastating flooding due to dam failure or overtopping.

The Bear Valley Dam is of special interest. It has been identified as an earthquake hazard by State engineers. The State requested the water surface elevation to be lowered, resulting in possible economic ruin for the Big Bear area. However, funding for the repairs was approved by the State legislature in 1987. Four of the dams listed, Mojave, Mojave River Forks, Parker and Antonio are federally owned and controlled. Mohave Forks is a major flood control dam, and the reservoir is normally dry except during floods, it is included because it blocks the potential flood paths from Lake Arrowhead, Lake Gregory, Green Valley Lake and Cedar Springs.

Other Geologic Hazards

Landslides

The Transverse Ranges are characterized by steep slopes, sharp narrow ridges and steep-walled, incised canyons and valleys. This is a setting which can produce numerous landslides when combined with adverse geologic structures, heavy precipitation and earthquakes. Elements of the Transverse Ranges in San Bernardino County consist of the San Gabriel, San Bernardino, Little San Bernardino and Pinto Mountains along with the Valley area south of the mountain ranges. All these areas are delineated by major faults.

In San Bernardino County, the regional distribution of landslides is controlled by such factors as steepness of slope, nature of bedrock and soil, and precipitation. Most slides form on slopes ranging from 5^{o} to 35^{o} with a small percentage occurring between 5^{o} to 15^{o} and a very few below 5^{o} (Radbruch, 1970). Several existing slides occur in the intensely sheared and faulted granitic and metamorphic rocks of the San Gabriel

FIGURE 12

DAMS OF SAN BERNARDINO COUNTY

Dam	Location	Owner	Type	Inundation	Capacity*
Alta Loma Basin 1	Rancho Cucamonga	San Bernardino County Flood Control District	earth	Yes	70
Alta Loma Basin 2	Rancho Cucamonga	San Bernardino County Flood Control District	earth	Yes	85
Bear Valley	Big Bear	Big Bear Municipal Wtr .	multiple arch	Yes	54,200
Cedar Lake	Big Bear	1st Cong Churh of L.A.	variable radius arch	No	30
Cedar Lake	Mohave R. Forks	St. Dept. Water Resources	rock	Yes	78,000
Chino Ranch No. 1	Chino Hills	City of Industry	earth	No	125
Copper Basin	Whipple Mountains	Metro Water District (MWD)	variable radius arch	Yes	22,000
Cucamonga Basin 3	Rancho Cucamonga	San Bdno Cty Flood Control	rock	Yes	54
Cucamonga Basin 6	Rancho Cucamonga	San Bdno Cty Flood Control	rock	Yes	250
Declenz Retention	South Fontana	San Bdno Cty Flood Control/ Riverside 6	earth	No	331
Devils Canyon Dike	N. San Bernardino	City of San Bernardino	rock	No	79
East Highlands	Highland	E. Highlands Ranch	earth	No	150
Gene Wash	Whipple Mountains	MWD	variable radius arch	Yes	6,300
Glen Martin	Mountain Home	Glen Martin Prop. Co.	earth	No	33
Green Valley Lake	Green Valley Lake	Green Valley Mun.Wtr Co.	variable radius arch	No	250
Lake Arrowhead	Lake Arrowhead	Arrowhead Association	Hydraulic fill	No	48,000
Lake Gregory	Lake Gregory	San Bdno. Co. Regional Parks	earth	Yes	2,300
Little Mountain	N. San Bernardino	San Bdno Co. Flood Control	earth	Yes	150
Mineral Hot Springs Lake	Waterman Canyon	Campus Crusade for Christ	earth	No	37
Mohave River	Hesperia	Army Corps	earth	Yes	191,000
Mohave River Forks	Mohave River Frks	Army Corps	earth	Yes	89,700
New Lake Arrowhead	Lake Arrowhead	San Bdno Cty Flood Control	earth	Yes	1,970
Parker	Colorado River	Bureau of Reclamation	earth	Yes	648,000
Perris Hill Reservoir	San Bernardino	City of San Bernardino	reinforced conc. tank	No	31
Rancho Cielito	Chino Hills	Rolling Ridge Ranch	earth	No	110
San Antonio	Upland	Army Corps of Engineers	earth	Yes	12,720
Small Canyon	Highland	San Bdno Cty Flood Control	earth	Yes	20
Wiggins No. 2	N. San Bernardino	San Bdno Cty Flood Control	earth	Yes	146
Yucaipa No. 1	S. Yucaipa	San Bdno Valley MWD	earth	No	92
Yucaipa No. 2	Yucaipa	San Bdno Valley MWD	earth	No	100
Yucaipa No. 3	Yucaipa	San Bdno Valley MWD	earth	No	32

(*acre/feet)

Mountains. The Wrightwood mudflows, an ever present threat upslope from the town of Wrightwood, originate in thoroughly fractured rocks in very steep terrain between the San Jacinto and San Andreas faults. Precipitation is often an important factor in the distribution of landslides in San Bernardino County. The higher elevation portions of the San Gabriel and San Bernardino Mountains receive high amounts of precipitation, which locally increases the tendency of landsliding. Other equally important factors are the relationship of bedding orientation and foliation to the slope direction, the physical condition and degree of weathering of rocks and soil, and the frequency, location, and magnitude of earthquakes.

California state geologic maps were utilized primarily to locate the distribution of bedrock types and to determine slope steepness. In the southwestern part of the Mountain and Desert areas several larger scale maps were also reviewed. These maps show only the distribution of rocks and surficial deposits, but usually do not show data on landslides except where the landslide deposits are large and mappable, such as the Blackhawk slide. Studies (Morton and Streitz, 1969) of landslide susceptibility in the San Gabriel Mountains are incorporated in the generalized slope stability maps.

On the Generalized Slope Stability Map the Mountain and Desert areas of San Bernardino County are divided into four landslide susceptibility zones. These classifications are generalized for regional planning and cannot be utilized for specific site planning

In all zones, local areas of low or high susceptibility could occur.

Zone 1, least susceptibility to landsliding, is assigned to areas where the degree of slope is 5^{o} and less (measured from the horizontal) and as determined on the maps. These areas are generally devoid of slides; however, they may include local areas of high susceptibility along steeper slopes, such as river banks that are too small to be shown on the generalized slope stability map.

Although the mountain ranges in the desert areas are probably nearly devoid of slides, most of the desert ranges are classified as Zone II, low susceptibility to landsliding. This classification includes slopes greater 5^{o} that receive less than 10 inches annual precipitation. Because of steeper slopes than Zone I, and locally faulted rock materials, these areas are subject to

rockfalls, rock debris slides and rolling boulders during a moderate to strong earthquake. The relative amounts of sliding would, of course, vary depending on the location and magnitude of the earthquake. Zone III, moderate susceptibility to landsliding, includes areas where slopes are greater than 5° and encompasses most of the San Bernardino Mountains and an area in the desert region where some landslides are known exist. This Zone III area generally receives greater than 10 inches annual precipitation and contains low to moderate amounts of landslides. Most of the rock types in Zone III areas, however, have relatively good characteristics with respect to sliding. During periods of heavy precipitation when the earth materials are saturated, a strong earthquake event would grossly increase the susceptibility of this area to landsliding.

The San Gabriel Mountains in San Bernardino County and a southwestern strip of the San Bernardino Mountains long the San Andreas fault is assigned Zone IV, high susceptibility to landsliding. In this area, all slopes are greater than 15°, receive annual precipitation greater than 10 inches and contain moderate to high amounts of landslides. Many of the geologic units in this zone have poor characteristics which increases their potential for sliding. The zone also includes areas of intensely fractured, deformed rocks similar to rock types in existing landslide areas.

There is also some overlap into the Mountain area where more detailed information was available. This map shows more detail than the slope stability map of the Mountain and Desert area, because of better availability of information and the larger scale map used. A dual system of degree of slope and generalized landslide susceptibility was used so that greater detail could be shown.

Though to a lesser degree, the steep fronts of the eastern San Gabriel and southwestern San Bernardino Mountains still present a major stability hazard especially adjacent to faults. Many of these areas lie within the National Forest. Therefore, it is assumed they will not be developed. They may, however, result in major problems in highway construction and maintenance. These landslide areas also cause debris in flood control, dam, and reservoir facilities. Landslide deposits are often generation areas for large debris flows or mudflows which happen during times of heavy precipitation, especially after the vegetation has been destroyed by fire or the erosion associated with off-road vehicles.

In summary, portions of the San Bernardino and San Gabriel Mountains have especially high potentials for landslides. The Chino Hills area, including about forty square miles of the County is underlain by landslide-prone marine rocks presenting the greatest potential slope stability problem in southwestern San Bernardino County.

The Wrightwood landslide area is one of especially critical concern in the County. It is an area whose primary movement is mudflow induced by high precipitation, especially in the spring when melting show produces extreme saturation levels. In addition, the San Andreas fault runs right through the middle of Wrightwood.

Subsidence

In San Bernardino County, probably the only types of subsidence to occur are due to groundwater withdrawal or hydrocompaction. The entire alluvial valley area in southwestern San Bernardino County, (the LaVerne, Chino-Riverside and Bunker Hill-Yucaipa areas) is experiencing subsidence from groundwater withdrawal. Subsidence reported in the Antelope Valley area in the northeastern corner of Los Angeles County may extend eastward into a small segment of this County. Subsidence of other basins in the desert has not been identified although as development increases so does withdrawal of groundwater. Some areas of mudflow deposits susceptible to hydrocompaction probably occur in San Bernardino County. They would be confined to the edges of the valley areas fronting the San Gabriel and San Bernardino Mountains on the Desert side. Little information is available to determine the extent of this problem in the County.

Erosion

The U.S. Soil Conservation Service and other soil agencies have done some mapping of soil types in San Bernardino County according to their susceptibility to erosion. In recent years, the Environmental Protection Agency has performed detailed research on means to control erosion. There are erosion and sediment control ordinances in effect in many areas including Lake Arrowhead Community Plan, Hilltop Community and Upper Waterman.

In the urban portions of the Valley area, especially at the base of the mountain ranges, erosion control is an important consideration of the individual homeowner. In

the desert areas, wind-blown sand is the most important form of erosion. There are areas which cannot be used for development without extensive stabilization measures. While identification of these areas was beyond the scope of this study these areas should be delineated. However, severe erosion can be a problem anywhere in the County. In any area where precipitation combines with ground areas denuded of their natural covering potential for erosion exists. Natural causes include landslide, fire, flood, and wind. Man-made causes include irresponsible grading and other construction practices, use of off-road vehicles and other indiscriminate disruption of fragile ecological surfaces.

Volcanic Activity

Volcanic rocks are widely distributed in San Bernardino County. Since the beginning of the Cenozoic era (65 million years) large quantities of volcanic rocks have been deposited. The most recent volcanic activity occurred during Holocene time (present to 10,000 years ago); the absolute time of the most recent activity is subject to speculation.

Much of the volcanic material consists of basalt flows, associated with quiet, non-explosive volcanic activity. However, some of this past activity was explosive as indicated by the formation of cinder cones and the distribution of pyroclastic materials (ash and tuff). There are no historic records of volcanic activity in San Bernardino County. The latest period of volcanic activity is probably represented by Amboy Crater which is estimated by Parker, 1963, to have formed "less than 6,000 years ago." Parker does not speculate beyond that somewhat less than precise estimate. Presumably, Amboy Crater could have still been active within the last 1,000 years. Figure 13 summarizes these areas.

Since volcanic eruptions have occurred in San Bernardino County intermittently during the geologic past and as late as less than 6,000 years ago. Therefore, it is possible that renewed volcanic activity can occur. Recent volcanic areas of San Bernardino County are classified as dormant, but not necessarily extinct. The likelihood of volcanic eruptions in the near future is very remote considering the relatively long period of quiescence. Furthermore, most of these volcanic centers are located in areas which are sparsely populated. However, as part of a long-range land use plan, some consideration should be given to volcanic hazards.

FIGURE 13

SUMMARY OF VOLCANIC AREAS

	NAME	LOCATION	COMPOSITION	ERA OF ACTIVITY
1.	Cima Volcanic Field	Northeastern San Bernardino County	Basaltic flows and Cinder Cones	Pleistocene/Holocene
2.	Lava Mtns.	Southeast of Ridgecrest	Pyroclastic rocks and basalts	Pliocene/Pleistocene
3.	Pisgah Crater-Sunshine Park	35 miles east of Barstow	Basaltic flows and Cinder Cone	Holocene/Pleistocene and Miocene
4.	Goldstone Lake-Bicycle Lake	15 miles northeast of Barstow	Basaltic flows	Pleistocene
5.	Black Mtn.-Opal Mtn.	15 miles NW of Barstow	Basaltic flows	Pleistocene/Pliocene
6.	Amboy Crater	central San Bernardino County	Complex basaltic and Cinder Cone	less than 6000 yrs.
7.	Turtle Mtn.	Southeastern San Bernardino Co.	Basalt & volcanic	Pleistocene/Tertiary
8.	Bitter Springs	Southeast of Goldstone Lake Bicycle Lake area	Basaltic flows	Pleistocene
9.	Pioneer town Area	10 miles northeast of Morongo Valley; east end of San Bernardino Mtns.	Basaltic flows	Pliocene/Pleistocene
10.	Bullion Mtns.	West of Amboy Crater in San Bernardino County	Basaltic flows	Pleistocene
11.	Bagdad	Northwest of Amboy Crater in central San Bernardino County	Basaltic flows and Cinder Cones	Pleistocene
12.	Rodman Mtns.	West of Pisgah Crater	Basaltic flow & Cinder Cone	Pleistocene
13.	Miscellaneous	(a) Pisgah to Amboy Crater (b) North end of Sacramento Mtns. (c) South of the State Range (d) Saddleback Mtn. near San Bernardino/Kern Co.	Basalt flows Basalt flow Volcanism Volcanism	Pliocene/Pleistocene Pleistocene Pliocene/Pleistocene

GLOSSARY

Alluvium - A general term for the sediments laid down in river beds, flood plains, lakes, fans at the foot of the mountain slopes, and estuaries during relatively recent geologic times.

Amplitude - The amount of vibration as measured from the average to the extreme.

Damping - Absorbtion of energy.

Dam inundation - The release of flood waters to downstream areas caused by failure of dam.

Earthquake - Perceptible trembling to violent shaking of the ground produced by sudden displacement of rocks below and at the earth's surface.

Epicenter - A point on the earth's surface vertically above the hypocenter or focus of an earthquake.

Erosion - A group of processes whereby earth or rock material is loosened or suspended and removed from any part of the earth's surface.

Fault - An earth fracture or zone of fracture along which the rocks on one side have been displaced in relation to those of the other.

Fault, Active - A fault that has had surface displacement during Holocene time (last 11,000 years).

Fault, Creep - The gradual slip of faults (also tectonic creep).

Fault trace - The line formed by the intersection of a fault and the earth's surface. The representation of a fault as depicted on a map.

Fault, well-defined - Its trace is clearly detectable by a trained geologist as a physical feature at or just below the ground surface. It can be located in the field with sufficient precision and confidence to indicate that the required site specific investigations would meet with some success.

Fault Zone - A fault, instead of being a single clean fracture, may be zone hundreds or thousands of feet wide; the fault zone consists of numerous interlacing small faults or a confused zone of gouge, breccia or other material.

Ground Rupture - Displacement of the earth's surface produced by fault movement associated with earthquake.

Hazard - The expected occurrence of a natural event that adversely effect human activity.

Hydrocompaction - Settling and hardening of land due to application of large amounts of water for irrigation.

Landslides - The downward and outward movement of slope forming earth materials under the influence of gravity.

Liquefaction - A process by which a water saturated sand loses coherence when shaken. Involved in the collapse of sand grains into intergranular voids which induces an increase in pore pressure and loss of strength. This loss of strength leads to a quicksand condition in which objects can either sink or float depending on their density.

Magnitude - The rating of a given earthquake is defined as the logarithm of the maximum amplitude on a seismogram written by an instrument of specified standard type at a distance of 62 miles from the epicenter. It is a measure of energy released in an earthquake. The zero of the scale is fixed arbitrarily to fit the smallest recorded earthquakes. The scale is open ended but the largest known earthquake magnitudes are near 8 3/4. Because the scale is logarithmic, every upward step of one magnitude unit means a 32 fold increase in energy release. Thus, a Magnitude 7 earthquake releases 32 times as much energy as a Magnitude 6 earthquake. Magnitude is not the same as intensity.

Risk - The likelihood of an undesirable event multiplied by its magnitude.

Seiche - An earthquake-generated wave within enclosed or restricted bodies of water (e.g., lakes and reservoirs).

Seismogram - The record of an earthquakes magnitude by a seismograph.

Seismograph - A device used to measure the vibration of the earth caused by a seismic event.

Subsidence - Generally level, vertically downward earth movement cause by reduction in soil water pressure.

FLOOD

FLOOD

I. INTRODUCTION

As with previously examined hazards, flood becomes a hazard only through contact with man and his development. Floods are naturally recurring events that have some valuable effects (i.e. replenishment of topsoils, beach sand and river gravel, and freshwater outflows to coastal estuaries). However, potential flood areas (flood plains) are especially appealing to man. These areas were the first that were accessible. Water transportation was economical and convenient. The flood plain also provided level areas for construction and rich soils for farming. Water was readily available for irrigation and home use. The atmosphere was generally aesthetically pleasing. But human encroachment into the flood plain resulted in hazard to man. Hazardous flooding has invariably become more severe as urban development replaces open land. In undeveloped areas, natural processes protect the land from excessive rainfall. Restrained by vegetation, much of the water from a heavy storm filters into the ground or is stored in holding areas such as lakes or reservoirs. However, when urban development such as street, paving and buildings, covers the land, most of the rainfall is unable to filter into the ground. Becoming run-off it tends to add to the flood volume downstream. This problem is further magnified by the filling and development of flood plains and water settling area, thereby impeding the floodwater flow and eliminating valuable water storage areas. Uncontrolled urbanization, in essence, aggravates the problem of flooding by hindering the passage of storm water and eliminating excess water storage areas, leading to increased property damage.

Flood control facilities are another element in the array of complex public services which ensure the public health, safety, and welfare. The planning, construction and maintenance of flood control facilities in San Bernardino County are primarily the responsibility of the County's Flood Control District, which is a part of the Transportation/Flood Control Department. The Flood Control District provides facilities and services in a manner similar to providers of other public services such as water supply systems, wastewater collection and treatment systems, public roads and highways, fire and police protection, and other public utilities.

A. Definitions

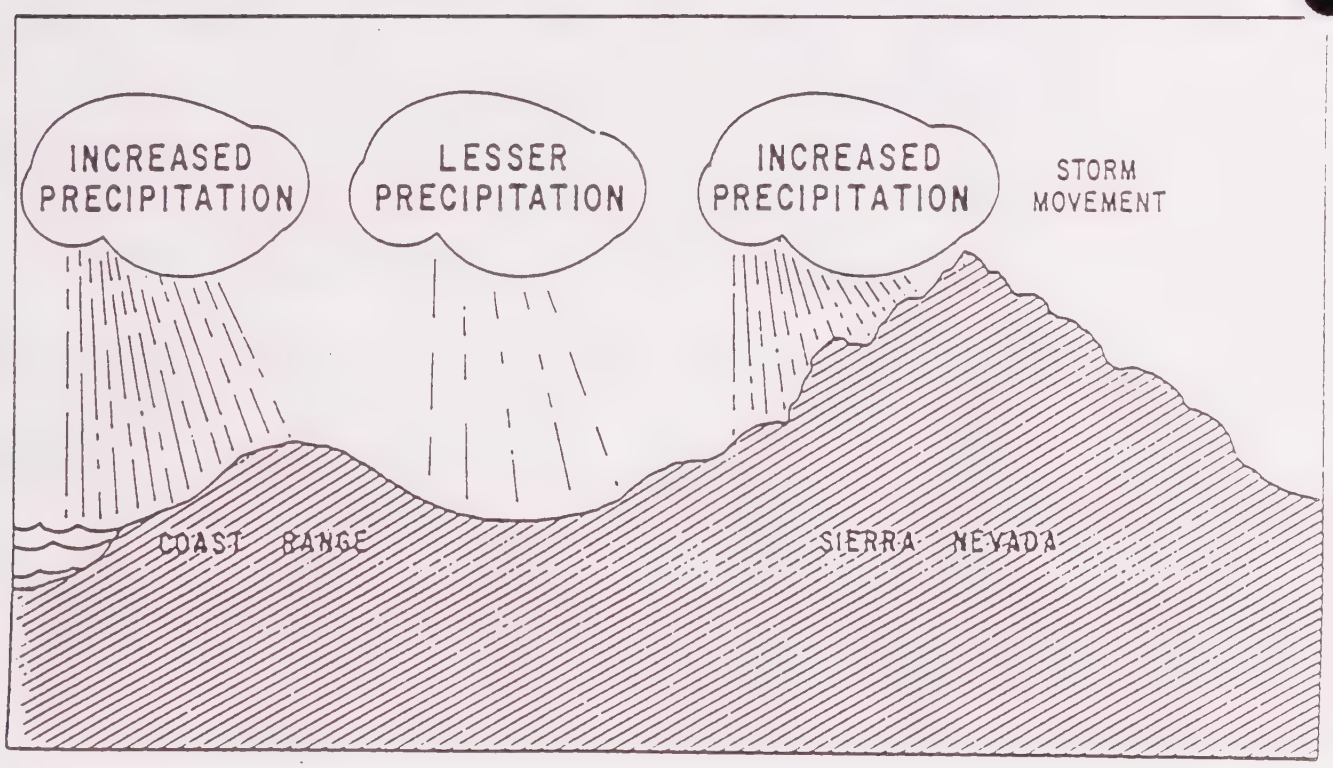
1. Flood

Flood is the rising and overflowing of a body of water onto normally dry land. Causes of flood include precipitation, seiche, subsidence and structural failure.

a. Precipitation

California precipitation can be separated into three distinctly different storm types: cold, warm, and tropical. Both cold and warm types are largely restricted to the State's wet season from October to April. Tropical storms can occur at any time. All storms moving easterly encounter the mountains. When they do, heaviest precipitation results. See Figure 1.

FIGURE 1



The cold type storm originates in the Gulf of Alaska and produces snow at low elevations. This type of storm rarely causes flood activity, although, in some cases, these storms do contribute to an extremely heavy snowpack. When coupled with sudden and prolonged heat spells, the resulting snowmelt can result in flood.

The warm-type storm comes out of the Pacific Ocean. It is California's most critical storm type as it sometimes involves prolonged, flood-producing rains. Warm-type storms produce snow at higher elevations than do cold storms, but also add to the snowpack. They can sometimes melt the existing snowpack especially if it is light and the rainfall is particularly heavy and prolonged, producing flooding. Because heavy and prolonged rains saturate the ground, fill reservoirs and generally tax the ability of normal drainages to contain them, they form the most severe threat. They also combine with other conditions to produce extreme hazards. Fire burn and landslide areas are just two examples of places where combination with heavy precipitation produces more severe hazards, in these cases, water, mud and debris flow.

The third type of storm, the tropical storm, originates west of Central America and Mexico as a full-fledged tropical storm or hurricane. This storm type usually has its most profound effect on deserts, interior valleys and mountains resulting in thunderstorms and producing devastating flash floods. These floods are of short duration but are very high in peakflow.

b. Seiche

Seiche is another natural cause of flooding. Seiche is large wave movement on an inland body of water such as a lake. It can be caused by earthquake or landslide and results in flooding of lakeside development. Seiche was further discussed in the Geologic Section.

c. Subsidence

Flood can also result from subsidence. Subsidence is the level, vertically downward movement caused by a lessening in ground fluid pressure. If that

area is adjacent to a body of water and the depression recedes below the elevation of that body, flooding occurs. Subsidence was also examined in the Geologic Section.

d. Structural Failure

The aforementioned causes of flood were primarily natural. Structural failure is primarily a man-made cause. The failure or lack of maintenance of any flood control facility (ie. dam, reservoir, levee, debris basin) can result in catastrophic flooding. Because development construction downstream of these facilities is reliant upon their integrity, failure of such structures results in large loss of property and sometimes life. Inundation from any of these facilities occurs when they breach or overtop. Breach can be naturally-induced, seismically, as can overtopping. They are, however, more frequently man-induced through lack of adequate maintenance or failure to provide an adequate facility for the degree of flood intensity. Dam inundation was also discussed in the Geologic Section.

2. Flood control

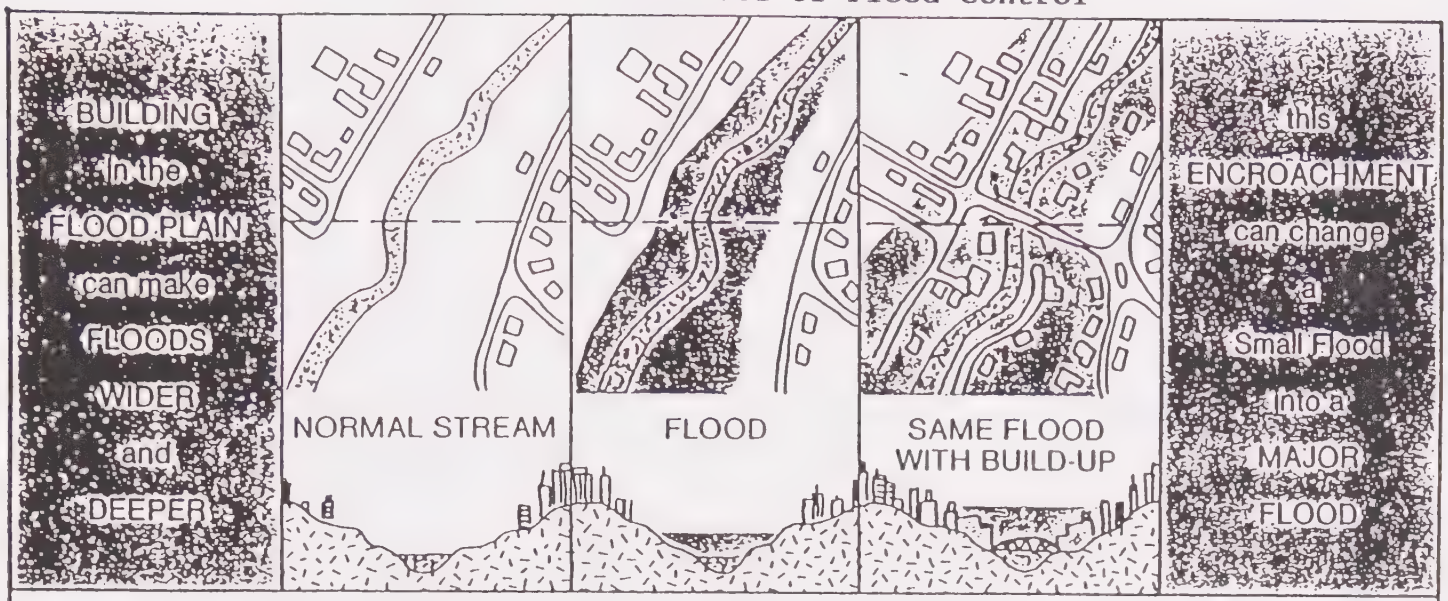
There are two basic categories of flood control: structural and non-structural. Structural facilities include man-made facilities such as dams and reservoirs, debris basins, levees, bypasses and channel modifications. Non-structural methods include land use planning and management (flood plain zoning, subdivision regulation, grading ordinances, hazardous land or channel acquisition), flood proofing requirements, flood forecasting and warning, and watershed treatment. Figure 2 depicts structural and non-structural methods of flood control.

a. Structural Facilities

Dams and Reservoirs

Dams with associated reservoir storage can reduce peak floodflows by storing storm water for later release. Flood storage may be the only purpose, or one of several purposes, for which reservoir space is set aside to store waters which, if unchecked, could contribute to downstream floodflows.

Methods of Flood Control



MEASURES TO REDUCE Vulnerability to Floods provide for a future with more freedom from flood damage, often at minor cost and little adverse effect on the environment . . .

REGULATIONS

(Zoning, Building Codes Subdivision)

• FLOOD PROOFING • RELOCATIONS •

MEASURES TO MODIFY FLOODS

are often required to alleviate existing problems and sometimes to forestall future problems

OTHER MEASURES

aid the Flood Plain occupant in coping with floods

• EDUCATION • TAX ADJUSTMENTS • FLOOD INSURANCE •

• WARNING & EMERGENCY PLANS •

Figure 2

The principle benefit derived from the operation of large flood storage reservoirs is the substantial reduction in peak flow downstream. When a large storm occurs above the reservoir, the storm waters are captured in the flood storage space, and, at the same time, releases from the reservoir are increased to move the storm waters downstreamwithout exceeding the dowstream channel capacity. If the storm and resulting high water are at or below the design flood,this operation will result in maintaining downstream flows at or below channel capacity. Sustained relatively high flows must be released from the reservoir for some time after the peak in-flow to evacuate water from the flood storage space to make room for the next storm flow.

Debris Basins

Debris basins have been constructed near the base of mountains on streams that carry excessive debris loads during the above-normal flows. Their purpose is to provide relatively small reservoirs or stilling-type basins that reduce flow velocities sufficient to allow large rocks, sediment, and debris to be separated from the storm waters which are allowed to pass through the debris basins. The debris is removed from the flows to protect downstream facilities (not previously constructed to handle debris) from damage caused by the debris loads. They would not be needed if downstream facilities had been designed to handle sediment and debris.

After a series of storms, these basins become filled with rocks, gravel, mud, trees, branches, and other material, and they become ineffective unless the debris is removed. In addition to trapping large pieces of debris and rock, they retain finer sediments which could be transported downstream. Debris is removed by heavy earthmoving equipment, and it is deposited at a land fill site or some other area where it should not be picked up by floodwaters.

Levees

Levees are the basic method of providing local flood protection in the United States. These earth embankments placed parallel to a stream along one or both sides contain storm waters and protect surrounding lands from inundation. A levee acts like a dam to hold back the weight of

the water against it on the streamside and at the same time must withstand the erosive force of water flowing along its face.

Levees may be placed close to the edge of a stream channel or may enclose a portion of the flood plain by being set back away from the stream. The side slopes of a levee may be quite steep, 2 to 1, or quite flat, up to 8 to 1. Steeper levee side slopes and those close to the channel where velocities are higher may require protection from erosion by placement of rock or other forms of bank protection. If space is limited, a special levee section called a floodwall may be used. A floodwall may be constructed of timber, stone, masonry, or reinforced concrete. Levees are generally the least costly method of providing flood protection, except in highly developed urban areas. They are also the method with the greatest potential risk of failure. As long as the design flood is not exceeded and levees are properly maintained, levees effectively contain storm waters. But levee failures do occur. Such failures can be caused by high waters overtopping a levee or eroding a portion of a levee, or by excessive seepage through a levee. Also, very large trees can be uprooted, leaving excessive voids in a levee, which can accelerate levee destruction. an initial small breach can lead to great damage and loss. Problems such as these are anticipated during a storm, and the agency responsible for a levee patrols it and takes the necessary "flood fighting" actions.

Bypass Systems

A bypass is an auxiliary channel used to pass floodwaters. Bypass systems are used in flood protection projects when the potential high flow is larger than the capacity of the existing river channel and a reasonable amount of leveed flood plain. This situation sometimes occurs when the natural river channel has built up its own levees through frequent overflows, leaving the natural channel relatively small. A comparable situation exists when development near the stream channel makes it economically prohibitive to set levees back from the stream channel to provide sufficient flowage area to pass the design flood. The bypass is usually leveed in whole or in part. Its major purpose is to carry enough floodwater so that the normal stream channel capacity is not exceeded.

Channel Modifications

Channel modifications are designed to increase the flow-carrying capacity of a stream. They have traditionally included increases in the width and depth of the stream and the straightening of its alignment. Grouted riprap or concrete linings are generally part of channel modifications. Figure 3 shows two examples of channel modifications.

Although considerably more expensive than levees, channel modifications have been constructed extensively in California. In the 40 year period from 1941 to 1980, government agencies have channelized nearly 1600 kilometers (1,000 miles) of California Channelization has been particularly common in urban areas where the high value and limited availability of land have precluded other methods of flood protection. It has been very effective in preventing flood damage. During the 1969 floods, the Los Angeles County Drainage Area Project prevented $1 billion in damage. The capital cost of the project was $400 million. When the capacity of a modified channel is exceeded, and there are no adjacent levees, there will be flood damage. This damage will not generally be of the catastrophic nature which can result from a levee failure.

b. Non-Structural Methods

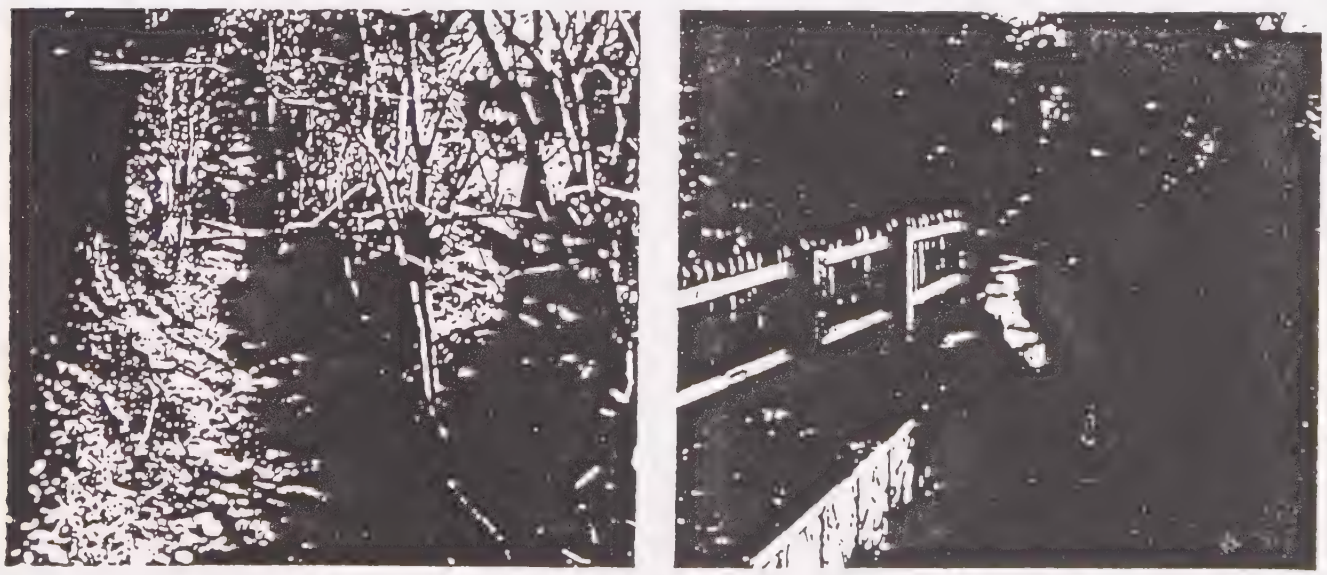
Land Use Planning and Management

The principal nonstructural strategy for reducing flood damage is comprehensive planning for and management of water and land resources throughout riverine watersheds and coastal environs. Although floods cannot and should not be eliminated, the environment can be successfully developed if the natural system is respected.

Technical data on topography, drainage, soil composition, climate, and other natural characteristics should be compiled and analyzed in light of the physical, social and economic aspects of the environment. This analysis can then be used to determine appropriate locations for building or not building.



UNATTRACTIVE is what some people call the concrete-lined Los Angeles River, seen above in its normal dry state. Besides being aesthetically displeasing to some, the all-concrete channelization results in loss of percolation and habitat. However, the section is efficient and provides the flood protection desired. (Los Angeles County Flood Control District Photo)



BEFORE AND AFTER photographs of Tamalpais Creek, in Marin County, demonstrate that channel modifications can be made without entirely destroying the beauty of the channel. In this stretch of creek, the channel was curved, first right, then left, to save oak trees. (U. S. Army Corps of Engineers, San Francisco District, Photos)

Implementation relies on regulations such as zoning ordinances, subdivision regulations, and health and building codes or on incentives that induce positive development practices.

Floodplain management objectives can also be realized in conjunction with programs for urban revitalization and preservation and through land acquisition by public bodies to control development.

Floodproofing

Floodproofing protects a structure or its contents against flood that would otherwise cause damage. Various methods may be considered, depending on site conditions, cost, and the nature of the facility to be protected. Floodproofing may be accomplished through elevating, dry floodproofing (waterproof-ing), or wet floodproofing. Methods other than elevating, however, are not considered suitable for new residential construction because of a rish inherent in floodproofing -- if a flood were higher than the elevation to which a building is floodproofed, the building would be suddenly inundated up to the flood elevation. In an industrial or commercial building, people will likely be awake and aware of the flood threat; in a residence, people may be asleep and unaware.

The more common and effective approach is elevating a structure above flood levels on compacted fill. Elevating methods also include the construction of raised foundations through the use of posts, piles, piers and foundation walls.

Dry floodproofing prevents floodwater up to a certain elevation from entering the facility. It is used primarily to protect existing structures, but is also allowed for new commercial and industrial uses under the National Flood Insurance Act.

Wet floodproofing allows water to enter the structure and is effective only where the structure itself would sustain little or no damage from a flood and where the uses of the facility can be protected from damage.

Flood Forecasting and Warning

Flood forecasting and warning involve prediction of river stages and timely notification of authorities so that people and property can be

evacuated. This is possible where there is enough time lapse between the precipitation and the time when the runoff causes water levels to rise in the stream. After the water reaches the stream channel, several hours or days may elapse before the flood crest reaches a flood hazard area, depending on the length and configuration of the river system.

A forecasting and warning service can be used to provide:

- River stage forecasts and flood warnings on unregulated streams.
- Downstream river stage forecasts on streams regulated by flood storage reservoirs.
- Reservoir inflow predictions that may be used to regulate reservoirs to minimize downstreams peak flows.

Factors affecting benefits of flood warnings include reliability of forecast, length of warning time, magnitude of reducible damage, and efficiency of response to warning. Effective response to flood forecasting depends almost entirely on a local agency acting on the information.

Watershed Management

Watershed management generally refers to practices and measures designed to improve land use, alleviate flooding, and reduce erosion and sedimentation. One critical area that must be examined is the fire/flood/erosion cycle. That denuded look a hillside displays after a major fire is an indication of severe hazard to downhill development. The raw soil can no longer absorb the moisture produced by rains, especially if they are heavy or prolonged. In addition, some solid types are actually made hydrophobic (water-repellant) by fire. Run-off is, therefore, accelerated, by up to 40%. The result can be floods and also increased capacity of the run-off to carry debris, from soil and mud to gravel and even boulders. Another effect of the fire/flood/erosion sequence is that because the earth does not retain the water in these areas, water does not percolate into the soil. It no longer reaches the water table. Valuable watershed is lost 95% of California's precious

water supply comes from and is stored in our wildland areas. Figure 4 illustrates the fire/flood/erosion sequence. Watershed management therefore, may be achieved through combinations of land treatment and structural measures. The land-treatment measures may consist of agricultural practices to enhance the vegetative cover designed to reduce overland flow and runoff and to control erosion, stabilization of stream channels, drainagemains, and laterals, and irrigation-water management. The methods also include revegetation of bare soil, especially after a fire, elimination of overgrazing, contour plowing, strip cropping, terracing, and mulch tillage. The objectives are accomplished by increasing the volume of surface storage for water, the rate of infiltration of water into the soils, and the capacity of the soil to store water. While these practices are effective in reducing the magnitude of the more frequent peak flows, the effect on the peak of flows of major floods is minor. The practices do, however, reduce erosion and the subsequent volume of sediment in streams, with consequent reduction in flood damage.

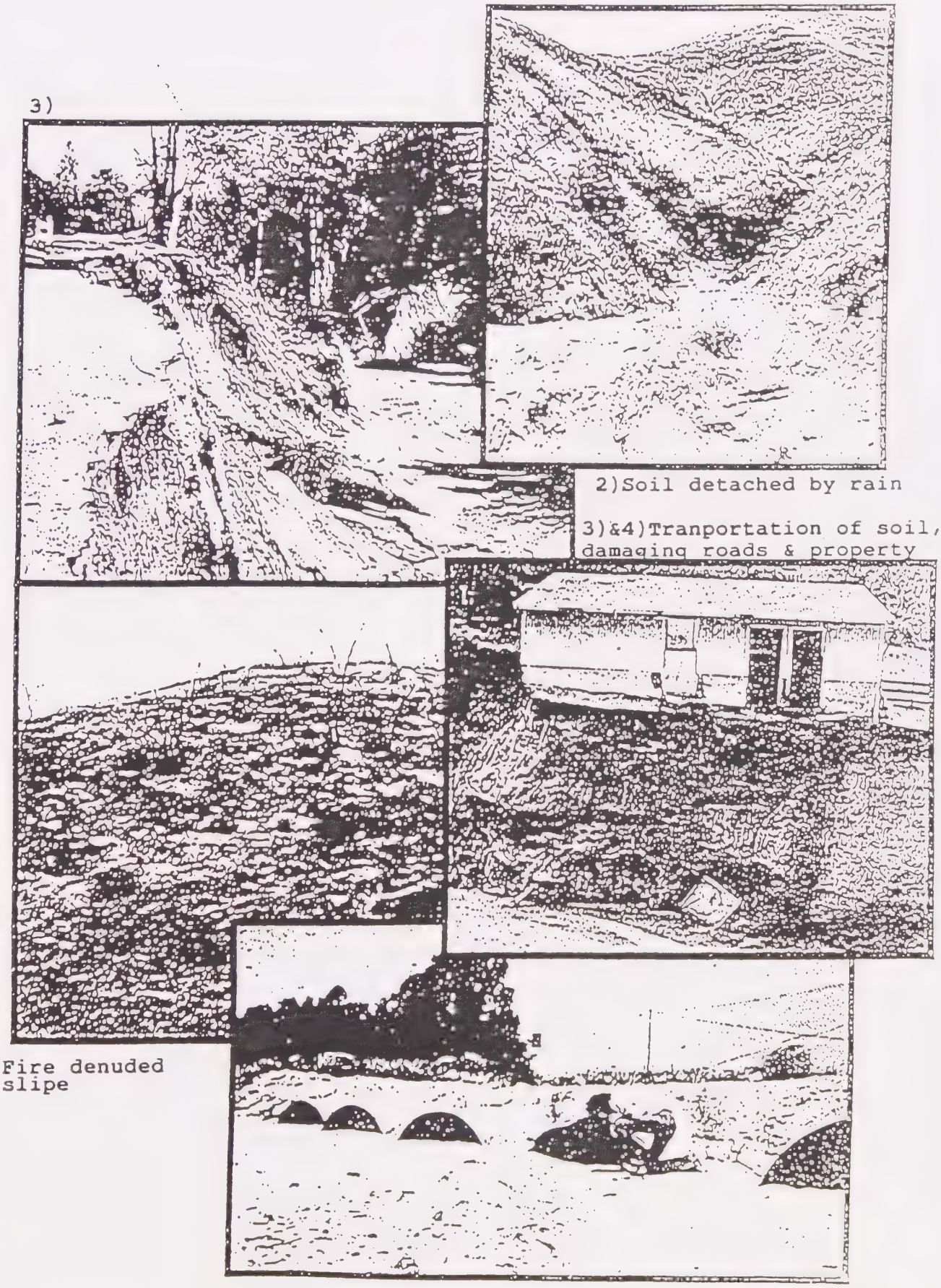
II. CURRENT STATUS

A. Sources of Data, Analysis and Mapping

1. Flood

FEMA, as previously mentioned, provides a majority of the flood hazard mapping in the County. That mapping, however, is not complete, nor is it always accurate. Therefore, the computerized mapping being done in conjunction with both the General Plan Update and recent Development Code update required by changes in FEMA itself involves many sources. Source documents include Army Corps of Engineer (ACE) study maps, San Bernardino County Flood Control District (SBCFCD) study maps, and FEMA preliminary maps, in addition to FEMA Flood Boundary and Floodway (FBF) maps and the County designated floodways. Coordination is being provided by the Drainage Review Section of the Office of the Surveyor. The Drainage Review Section has developed a data base containing thousands of aerial photographs used to determine historic watercourses and watersheds in the review of land development projects. The intent is to provide a consistent data framework for flood information, countywide in scope, that will also be accepted by FEMA.

Fire Erosion Sequence Figure 4



2. Dam Inundation

Dam inundation mapping was also accomplished through a variety of sources and includes areas of possible inundation by SBCFCD percolation basins. SBCFCD provided those maps, which have been digitized. Inundation by Army Corps of Engineers facilities area also included. Maps were provided by the Office of Emergency Services which coordinates County disaster services. The design flood (flood magnitude for which a specific project was designed) for dam inundation areas is based on maximum flood for Army Corps of Engineers facilities. The probable maximum flood is that discharge that "may be expected from the most severe combination of critical meteorological and hydrological conditions that are possible in the region". In other words, conditions reflected are of an extreme nature with a very low probability of occurrence. Other design criteria used include standard project flood (the most severe combination of meteorological and hydrological conditions that are considered reasonable, about a 500 year storm) and the intermediate regional flood, or the 100 year storm (one that, on the average, occurs once in 100 years, although it can occur in any year).

3. Flood Control

Information has been gathered from the County's Flood Control District. Maps show existing and proposed flood control facilities. Various reports discuss the history and organization of the District. Five-year construction programs for the six Flood Control District Zones within the County list, in addition to five-year capital improvements, the ultimate facilities required.

As part of the effort to organize and analyze data gathered from various sources, the San Bernardino County Land Management Department has contracted with a consultant, URS Corporation, to design a computerized system for the assessment of the need and availability of various public services, one of which is flood control facilities. The first phase of the system development is nearing completion. However, it is not expected that the system will be fully operational prior to the completion of the two-year General Plan Update, but may continue as part of the five-year program.

The County's Victor Valley Infrastructure Enhancement Program (VVIEP), which commenced in early 1986 and is currently ongoing, will identify overall public service

demands and needs in that area of the North Desert, including flood control facilities. Information from this project will be utilized to the maximum extent possible for the Victor Valley area.

B. History and Existing Conditions in San Bernardino County

1. Flood History

Flooding has long been recognized as a serious problem in San Bernardino County. According to the ACE, the Santa Ana River area forms the worst flood threat in the Western United States. In recorded time, severe flooding occurred throughout the County almost every year with especially severe flooding noted in 1824, 1862, 1867, 1891, 1910 and 1916. The flood of 1824 was so violent it actually altered the course of the Santa Ana River. The flood in 1862 is by far the greatest of record, approximately doubling the flood volume of the 1938 flood. It was recorded that all flat land from Loma Linda to the hill at Third Street and Arrowhead Avenue in San Bernardino was underwater, extending for miles up and down the Santa Ana River. In 1867, the magnitude was close to that in 1862 although it was written that, "Since the first flood had cleaned the channels, the damage done by the second storm appeared to be less." In 1883-84 the wettest year of record was reported with 36.5 inches of rainfall. The flood it spawned, on March 6,1884, was somewhat less than 1938's although significant damage was done to newly installed railroads and the course of the Santa Ana was again altered. Floods of 1891, 1910 and 1916 also caused severe damage. At one point an entire community of 20 families in East Highland was swept down Plunge Creek. In another, the Santa Ana was two miles wide and twenty feet deep.

In March 1938, a series of torrential rainstorms resulted in the worst flooding of the century affecting virtually every community in the County. More than 30 inches of rain fell in less than one week. The flooding was responsible for the deaths of eight people in the County and millions of dollars in property damage. Valuable watershed was lost as the torrent poured out of the canyons destroying everything in its path: homes, orange groves, bridges, roads and railroad tracks. Whole communities were isolated for days. Both the Santa Ana and Mojave Rivers were at flood volume. The formation of the San Bernardino County Flood Control District was a byproduct of the devastation.

The District presently exercises control over all main streams in the County, acquires right-of-way for all main channels, constructs channels, and has carried out an active program of permanent channel improvements in coordination with the U.S. Army Corps of Engineers. However, due to the enormity of the problem and the constantly increasing run-off caused by additional urban development, flooding remains a problem in portions of San Bernardino County.

More recent flooding in 1969, 1978 and 1980 prove the point. In 1969, devastating flood-inducing storms hit the County in both January and February. They caused the most damaging floods of record in the County. Rainfall intensities and amounts were greater than those occurring in 1938, as were run-off peaks (except for the Mojave River). Although flood control facilities functioned very well in the January floods, there was not enough time to bring them back to standard before the February deluge. Figures 5 through 8 show flooded areas throughout the County. In February nearly twice as much damage was sustained though the intensity was slightly less. (In the Mojave River area monetary losses were more than 10 times those incurred in January.) Figure 9 gives a breakdown of financial losses of the two storms. This is, however, only a small portion of those losses that would have been sustained without flood control protection. Figure 10 gives a breakdown of the damages prevented by Army Corps of Engineer flood control projects in the County in 1969 in comparison to the original project cost. Throughout Southern California 115 people lost their lives.

Since 1969, the County has been relatively stable with a few more localized exceptions:

- 1976 - localized high intensity rainfall in the East Desert (Morongo and Yucca Valleys and Twentynine Palms) and Redlands areas. Over $1,000,000 in public and private damage occurred in Redlands alone. $750,000 damage was done to Countywide flood control facilities.

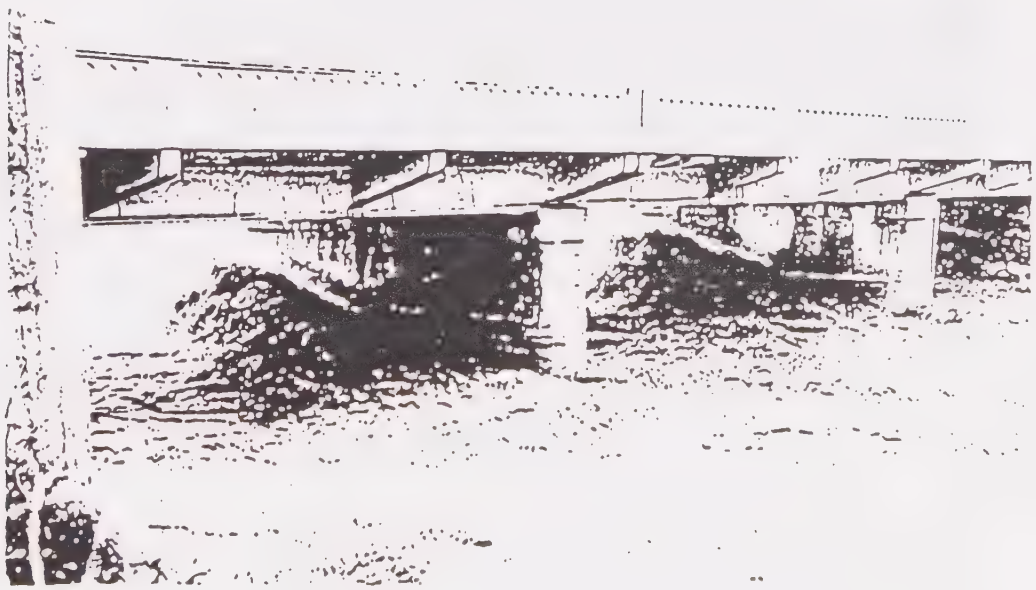
- 1978 - flood control functioned well but levees in Cucamonga Channel where severely eroded resulting in evacuation of a portion of Rancho Cucamonga. (This area is now protected by the Cucamonga Creek Corps of Engineers channel.)

January 1969 Flood on the Mojave River Figure 5



A floodwave 4 feet high moves over flood plain between the river and homes off "E" Street in City of Victorville.

January 1969 Floods Figure 6



Angry waves formed by Santa Ana River floodflows attack "E" Street bridge, which was badly damaged by the January and February floods. (Picture courtesy of San Bernardino Valley Municipal Water District)

February 1969 Floods

Figure 7

MUDFLOWS FROM YUCAIPA CREEK IN WILDWOOD CANYON ENGULF BUILDINGS



Only upper parts of Calimesa home protrude through mud 5 feet deep.

February 1969 Floods

Figure 8

BOULDERS FROM LYTLE CREEK BATTER HOMES AND CARS



A once comfortable home in Scotland village lies buried in boulders. Both floods pommelled the village.(Picture courtesy of Sun-Telegram)

Summary of Flood Damages - Both Floods

A summary of flood damages from both the January 1969 flood and the February 1969 flood is given in the following table:

Summary of flood damages from both the January 1969 flood and the February 1969 flood along various streams in San Bernardino County

Type of property	Damages		
	Physical damages	Business loss and emergency cost	Total
JANUARY 1969 FLOOD			
Residential	$4,605,000	$731,000	$5,336,000
Business and industrial	3,707,000	1,156,000	4,863,000
Agricultural	1,141,000	621,000	1,762,000
Highways and roads	3,007,500	1,094,000	4,101,500
Utilities	833,500	153,000	986,500
Public	76,000	30,000	106,000
Other public (churches)	19,000	2,000	21,000
Flood control	3,788,000	219,000	4,007,000
Railroads	1,065,000	717,000	1,782,000
Vehicles	180,000	40,000	220,000
Total	18,422,000	4,763,000	23,185,000
FEBRUARY 1969 FLOOD			
Residential	5,545,000	1,026,000	6,571,000
Business and industrial	2,342,000	1,075,000	3,417,000
Agricultural	3,762,000	604,000	4,366,000
Highways and roads	2,154,500	976,000	3,130,500
Utilities	862,500	229,000	1,091,500
Public	334,000	90,000	424,000
Other public (churches)	18,000	2,000	20,000
Flood control	5,272,000	247,000	5,519,000
Railroads	3,328,000	3,065,000	6,393,000
Vehicles	60,000	10,000	70,000
Total	23,678,000	7,324,000	31,002,000
Grand total	42,100,000	12,087,000	54,187,000

Figure 10

Damages prevented by Corps of Engineers projects during 1969 floods in San Bernardino County

Project		Damages prevented by project		
Name	Project Construction Cost	January flood	February flood	Total
SAN BERNARDINO COUNTY				
City Creek levee	$ 885,000	$ 2,000,000	$ 400,000	$ 2,400,000
Devil, East Twin, and Warm Creeks channel improvements and Lytle Creek levee	11,088,000	1,850,000	800,000	2,650,000
Lytle and Cajon Creeks channel improvements	8,214,000	11,600,000	1,600,000	13,200,000
Mill Creek levees	813,000	8,800,000	2,600,000	11,400,000
San Antonio Reservoir and San Antonio and Chino Creeks channel	17,925,000	20,800,000	6,300,000	27,100,000
Quail Wash levee	252,000	0	0	0
Subtotal	$39,177,000	$45,050,000	$11,700,000	$56,750,000

- 1980 - high intensity rainfall hit the San Bernardino mountains causing extensive damage to denuded watershed burned by the Daley and Shadow fires of September 1979. Debris basins above the City of San Bernardino were severely taxed with one, Harrison Basin, overflowing, 25-30 homes were completely destroyed; 25 more were severely damaged. Small Canyon Basin also overflowed, pouring mud and debris into the residential areas below Highland Avenue and Mountain Shadows. Over 30 inches of rain fell between January and March. Over $18,000,000 in damages were incurred throughout the County, including $8,000,000 to flood control facilities alone. Ten people died throughout the County.

It should be noted that there are extensive areas in the County that have not been evaluated for flood hazard, particularly those areas subject to flash flooding in the Desert. For that reason, other areas should be evaluated. Dry lakes, are subject to flooding in the event of severe rainstorm.

Inundation of Debris and Percolation Basins are also included. These maps represent a "severe case scenario". Dam inundation has occurred in the County in the past with severe results. In 1938, flood waters burst a dam at Running Springs "roaring over Highway 18 as if it were the top of Niagara Falls." As previously discussed, the failure of Harrison Canyon flood control basin in Winter, 1980, caused substantial damage to properties downstream, confirming the importance of development restrictions in inundation areas. In 1983, '84 and '85 the Colorado River inundated property in the flood plain as a result of development encroachment. A heavy snowpack filled reservoirs, requiring the release of more water than expected. A false sense of security engendered by the construction of the Glen Canyon Dam in addition to the Hoover Dam resulted in the intrusion of residences and businesses in the flood plain. Millions of dollars of damage was incurred. During 1983 alone $3 million in flood insurance claims and $4.9 million in other forms of disaster relief was paid by the Federal government even though the Colorado River is one of the most highly regulated river systems in the Nation.

2. Flood Control

a. San Bernardino County Flood Control District (SBCFCD)

The principle agency within the County which constructs and maintains flood control facilities is the San Bernardino County Flood Control District.

The San Bernardino County Flood Control District was created by the California Legislature by the San Bernardino County Flood Control District Act, Chapter 73, Statutes of 1939, adopted and effective April 20, 1939.

The District was formed as an urgency and progressive measure for the preservation and promotion of public peace, health and safety as a direct aftermath of the not unprecedented but nevertheless most disastrous floods of March, 1938, which caused loss of lives and millions of dollars of property damage within the County.

By legislative action, the District is empowered with broad functions including flood control and prevention; water supply, its protection, development and conservation; watershed and watercourse protective measures; and other wide powers in harmony with these interests. Associated with these are the further powers necessary in their performance such as taxation, bonded indebtedness, land and water rights acquisition and cooperative undertakings with local, state and federal agencies.

The District is countywide, the external boundaries coinciding with those of the County of San Bernardino including a territory of 20,000 square miles with a 1987 population of 1.2 million persons. Within the domain are regions of differing physical geography including the Santa Ana River Basin or San Bernardino Valley and watersheds in the southwest portion of the County; the mountain ranges of the eastern San Gabriel and San Bernardino mountains attaining elevations of 11,000 feet and bounding the San Bernardino Valley; the Mojave River Valley and Basin wending northerly and easterly through the

County, easterly of the Great Basin divide; the Colorado River Valley along the easterly border the County; and the vast plateau areas of semi-desert.

The authorizing Act designates the Board of Supervisors of the County of San Bernardino to serve as the ex-officio Board of the San Bernardino County Flood Control District and provides that all County officers shall have corresponding duties and responsibilities for the Flood Control District.

Since the formation of the District in matters of flood control, special emphasis has been placed on the control of the principal streams and channels of the County in harmony with original intents. Accordingly, as a prime objective, the District assumes jurisdiction over the rivers or major streams and their principal tributary watercourses and main channels, assigning a position of priority thereto.

Since its inception until 1978 the District operated similarly to County Departments with the additional authority provided a state created special district. The Flood Control District provided major flood control and water conservation in incorporated and unincorporated areas of the County, developing a system of channels, levees, basins, dams and water spreading facilities valued in excess of one billion dollars at today's construction costs.

The passage of Proposition 13 in June 1978 severely reduced the District's funding, cutting revenue by approximately two-thirds. By 1980, after all funding reserves were depleted, the District was being forced to borrow from the County General Fund to meet needs required to complete construction projects already underway and also repair storm damaged facilities destroyed by the heavy 1980 rains. The District staff was reduced by fifty percent and all Flood Control functions and operations were combined with the County Transportation Department.

Currently, there are approximately 90 District employees and 280 Transportation Department

employees working for the combined Department to provide necessary Transportation and Flood Control services.

The two percent per year tax increase and land development activities since 1978 have increased the District revenues almost to pre-Proposition 13 levels; unfortunately, inflation has increased more dramatically, and current flood control funding allows for little more than necessary ongoing office operations and annual operation and maintenance of existing facilities. The continued development of San Bernardino County's vast vacant acreage makes construction of new and upgrading of existing facilities imperative. Today, the District and County are pursuing numerous avenues to supplement existing flood control revenue so that the current level of flood protection can be maintained and hopefully upgraded.

i. Objectives and Purposes of the SBCFCD

The objectives and purposes of the SBCFCD can be summarized as follows:

- To provide for the control of the flood and storm waters of the District.
- To provide for the control of flood and storm waters of streams that have their source outside of said District but which flow into District.
- To conserve such waters for beneficial use by spreading, storing, retaining and causing to percolate into the soil within or without District.
- To save or conserve in any manner all or any of such waters.
- To protect from such flood or storm waters the watercourses, watersheds, public highways, life and property in said District.

- To prevent waste of water or diminution of the water supply in District.

- To prevent exportation of water from the District.

- To obtain, retain and reclaim drainage, storm, flood and other waters for beneficial use in the District.

ii. Powers of the SBCFCD

The SBCFCD is declared to be a body corporate and politic and as such shall have power:

- To have perpetual succession.

- To sue and be sued in the name of said District in all actions and proceedings in all courts and tribunals of competent jurisdiction.

- To adopt a seal and alter it at pleasure.

- To take by grant, purchase, gift, or otherwise, and to hold, use, lease or dispose of property necessary to the full exercise of its powers.

- To construct, maintain and operate improvements within or without the District to carry out the objects or purposes.

- To store water in surface or underground reservoirs within or outside of the District for the benefit of the District; to conserve and reclaim water for present and future use within the District; to appropriate and acquire water and water rights, and import water and to conserve same for any useful purpose of the District; to commence, maintain,

intervene in any action or proceeding involving ownership or use of water or water rights; to prevent unlawful exportation of water from said District; and to prevent pollution or otherwise rendering unfit the surface or subsurface water.

- To control the flood and storm waters of said District; to conserve such waters for beneficial and useful purpose: and to protect from damage from the flood or storm waters the watercourses, watersheds, public highways, life and property.

- To have and exercise the right of eminent domain.

- To enter on any land to make surveys.

- To carry on technical and other investigations, make measurements, collect data, and make studies pertaining to water supply and control of floods.

- To incur indebtedness and to issue bonds in the manner provided.

- To cause taxes to be levied for the urpose of obligations of the District.

- To make contracts and to employ labor, and to do all acts necessary for the full exercise of all powers vested in said District.

The Board of Supervisors of San Bernardino County shall be, and they are hereby designated as, and empowered to act as,

ex-officio the Board of Supervisors of said San Bernardino County Flood Control District.

There are numerous programs designed to reduce flood losses, as mentioned above, including both structural and non-structural approaches, some directed at preventing floods, others at controlling these floods that cannot be prevented. The structural measures of the County Flood Control District includes flood water storage areas such as dams, reservoirs and debris basins, and the construction of related facilities such as levees and channel improvements. The non-structural measures or the flood plain management, as it is commonly referred to, include flood plain zoning, subdivision regulations, grading ordinances, and hazardous land or channel acquisition. In urbanized areas such as many portions of the Valley Planning Area, the structural measures are most feasible; on the other hand, in urbanized rural land, such as the Desert Planning Area, the non-structural or flood plain management approach appears to be more effective.

iii. Programs of the SBCFCD.

The programs of the SBCFCD are summarized as follows:

- o Flood protection from major streams
  - District projects for channel and levee improvements.
  - District projects for flood water retention and debris basins.
  - Federal project programs for channel and levee improvements.
  - Federal projects for flood water regulating dams.

- o Water conservation.
  - Water spreading ground development and operations.
- o Water conservation basin development and operations.
  - Protection of native water conservation areas.
  - Pit conservation basin development through gravel plant operations.
- o Watershed protection.
  - Cooperative undertakings with state and federal agencies in watershed, fire trail and fuel break construction and maintenance.
  - Cooperative undertakings with state and federal Agencies in insect control in forested areas.
  - Watershed burn reseeding in connection with state and federal agencies.
- o Protection of streams and watercourses.
  - Acquisition and control of native floodways.
  - Cooperative flood plain information studies with state and federal agencies.
  - Flood plain regulations in coordination with cognizant planning agencies.
- o Storm drain construction.
  - Comprehensive storm drain planning.

- Construction and operation of main trunk storm drains.

- Cooperative storm drain projects with incorporated cities.

o Hydrological programs.

- Rainfall, runoff and climatological data collection and dissemination.

- Ground water data collection through well measurements.

- Ground and surface water sampling and quantitative analysis.

- Cooperative studies of ground and surface waters with U.S.G.S.

o Debris removal programs.

- Debris removal from basins and channels by contractor borrow operations.

- Stream bank protection by waste concrete and rock disposal.

o Advance right-of-way acquisition.

- Advance right-of-way acquisition for future channels, basins and spreading grounds.

- Opportune right-of-way acquisition through delinquent tax sales.

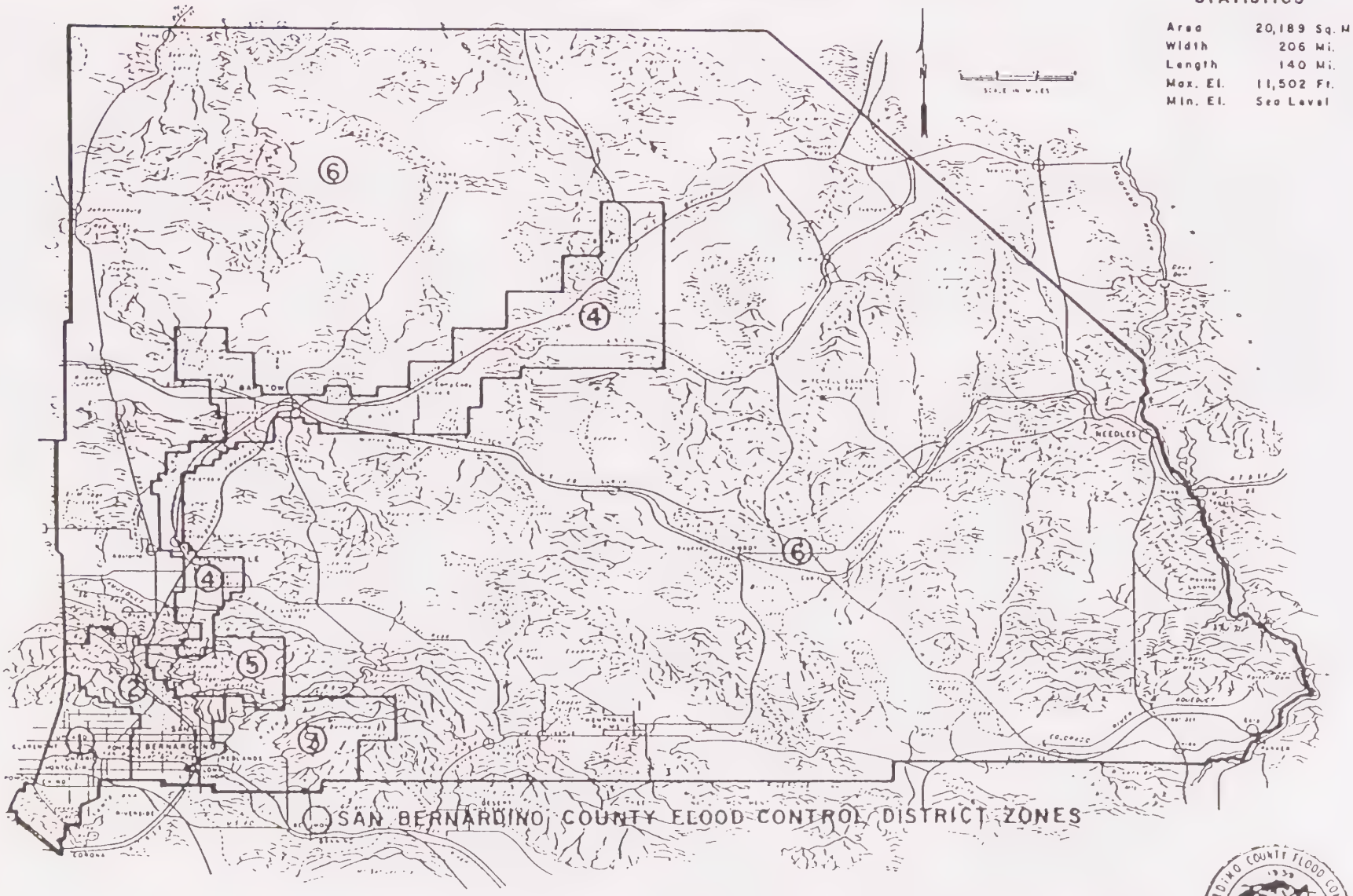
- o Flood Hazard Investigations.
  - Report on flood hazards to city and county planning commission on tentative subdivisions, mobile park developments, zone changes and site approvals.
  - Reports on flood hazards to state real estate commission, federal V.A. and F.H.A.
  - Consultation and dissemination of information to property owners.
- o Flood operations
  - Flood warnings, telemetry systems to monitor watershed rainfall and main canyon runoff.
  - Storm patrols.
  - Flood operations of district facilities.
  - Cooperative flood operations with United States Army, Corps of Engineers.

b. Flood Control District Zones

The SBCFCD is subdivided into six zones with interests, responsibilities or geographical divisions, distinctive of the particular zone. In matters of taxation or ventures, each zone functions independently although by mutual arrangements joint activities may be entered into. Figure 11 shows the SBCFCD zones County-wide, while Figure 12 shows the zones in the County's Valley and Mountain planning areas.

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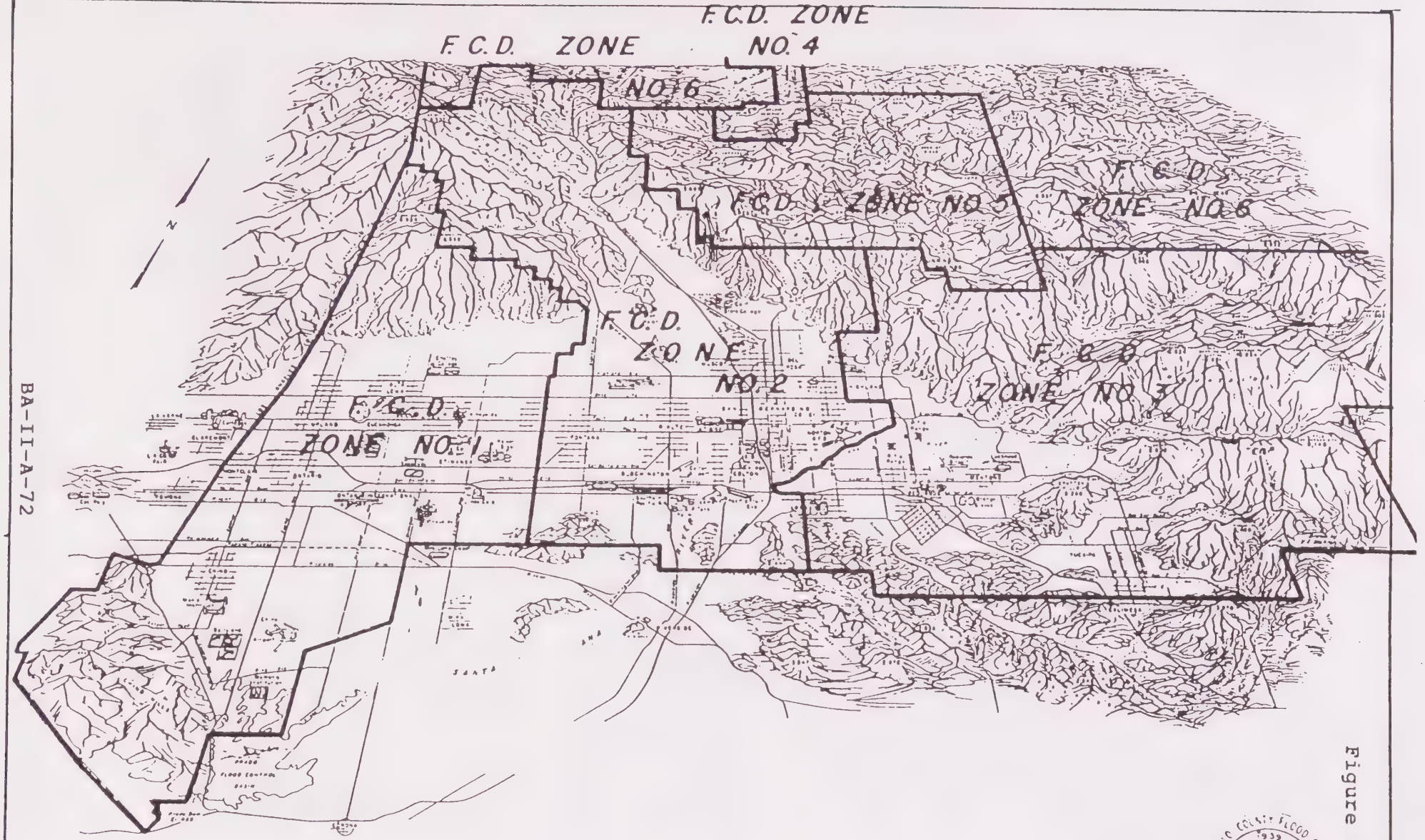
SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT



San Bernardino County
FLOOD CONTROL DISTRICT

Figure 11

S.B.C.F.C.D. PLANNING FILE BM-01-18/b



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Figure 12

San Bernardino County
FLOOD CONTROL DISTRICT

Southwest Portion

The six zones, although bounded by defined limits, are generally described as follows:

		APPROXIMATE AREA
ZONE 1 -	The westerly portion of the San Bernardino Valley extending from Beech Avenue in the Fontana area to the Los Angeles County line, all south of the San Gabriel mountain range divide. This embraces the cities of Upland, Montclair, Ontario, Chino, Rancho Cucamonga, and part of Fontana.	277 sq. m
ZONE 2 -	The central area of the San Bernardino Valley easterly of Zone 1 to approximately the Santa Ana River and City Creek demarcations. This includes the Cities of Fontana, Rialto, San Bernardino, Grand Terrace and Colton, together with the communities of Devore, Muscoy, Del Rosa, and Bloomington	315 sq. m
ZONE 3 -	The easterly end of the San Bernardino Valley east from Zone 2 including the Cities of Redlands, Loma Linda, and Highland, and the communities of Mentone and Yucaipa.	393 sq. m
ZONE 4 -	The Mojave River Valley from the San Bernardino mountains to Silver Lake and including the Cities of Barstow, Hesperia(part of), and Victorville, and all or portions of the communities of Apple Valley, Oro Grande, Helendale, Hodge, Hinkley, Yermo and Daggett.	1,129 sq. m
ZONE 5 -	The mountainous watershed of the Mojave River on the crest and north slopes of the San Bernardino mountains including the communities of Crestline, Lake Gregory, Lake Arrowhead, Running Springs and Green Valley Lake.	175 sq. m
ZONE 6 -	The remainder of the County not embraced by other zones including portions of the San Gabriel and San Bernardino mountains and the desert portion of the County. This embraces the Cities of Needles, Adelanto, and Twentynine Palms, Big Bear Lake, Hesperia (part of), and the communities of Trona, Phelan, Lucerne Valley, Amboy, Morongo Valley, Yucca Valley, and Joshua Tree.	17900 sq. m
	APPROXIMATE TOTAL DISTRICT	20,189 sq. m

Each zone of the District is represented by a Citizens Advisory Committee, composed of eleven members and serving by appointment of the Board of Supervisors without compensation. Each committee is formed of spirited citizens and public officials with unselfish and devoted interests, organized to meet annually or on call to afford recommendations to the Board of Supervisors on matters of tax levies, budgets, work programs, priority of projects, ventures and other counsel. Almost without reservation, the recommendations of these organized committees have been accepted by the Board in its administration of District functions. The mayor of each incorporated city in the District is a committee member with full standing for the appropriate zone.

c. Flood Control District 5-year Construction Program

Since its inception in 1938 the Flood Control District has worked to provide major flood control and water conservation in incorporated and unincorporated areas of San Bernardino County, developing a system of channels, levees, basins, dams and water spreading facilities valued in excess of one billion dollars at today's construction costs. Today this system is still composed primarily of interim type facilities which are subjected to a high degree of storm damage and maintenance costs.

The 5-year construction plan for each Flood Control District Zone is intended to initiate a program of upgrading these well-used and deteriorating drains to ultimate type improvements. All existing and proposed facilities have been categorized as to importance and needs, using the following designations:

Regional - Major drainage facilities, usually having a tributary mountain watershed, necessary to provide drainage outlet for upstream or lateral drains.

Secondary - Larger drainage facilities conveying locally generated drainage flows. These normally serve as lateral drains Regional facilities.

Local - All other drainage facilities used to control or convey smaller drainage flows to Secondary or Regional facilities.

Because of limited District Funds for new construction and the high cost, the 5-year programs are directed to the construction of only priority Regional facilities in each Zone. It can be noted on the summary sheets that appear as Figures 13 through 17 that this limitation does not provide sufficient funding to complete construction of the needed drains within the next five years. (No summary sheet is available for Zone 5; the only sizeable project is Hunsaker Drain in Running Springs. This makes it most important to seek alternate funding sources and the District is actively pursuing this plan of action. Should the District be successful in any alternate funding endeavors, naturally this 5-year program will be modified and the available construction funds will be used toward the local share of these projects.

In addition to the Regional construction aspect, this program does recognize the need for certain small construction projects. A small percentage of available funds designated in the Zone plans are for this purpose; however, it is not practical to try to project exactly what these needs may be over the length of the program. The District has elected to let these projects be identified by Operations personnel on a yearly basis, and at that time be reviewed by Zone Advisory Committees. These funds are identified as major maintenance projects in the plan.

There are certain smaller Zones, such as Zone 3, where available funding is so limited it is not feasible to attempt a construction program for even the most needed priority drains. In these Zones we are forced to rely on alternate funding for Regional project construction and the 5-year program reflects only major maintenance allocations.

Figure 18 indicates the most recent budget figures for Zones 1 through 6 in the five-year period from 88-89 to 92-93, which amounts to over $40 million. Figures 13 through 17 also show the ultimate facilities that are required, with cost estimates. The cost for the total facilities requirements for the six Zones are summarized below:

Zone Cost Estimates (Millions)

1	69.7
2	77.1
3	108.5
4	40.5
5	.3
6	68.7
TOTAL	364.8

A Project Participation Point Formula has been developed by the District in conjunction with the Zone 1 City Engineers. The formula was developed to provide an equitable means of comparing proposed city flood control projects for the purpose of ranking them in order of highest priority. The District will, in turn participate in funding the design and construction of the projects by order of ranking. The maximum yearly funding available from the District for participation equals tax collected from city area within the zone, divided by total tax collected within the zone, times 25% of the District's Capital Improvement Budget.

d. Flood Control District 87-88 Budget

The District's prime source of funding is property taxes, which have increased approximately 11 percent. The total Budget is over $30 million, which is $11 million more than usual due to $10 million from the City of Rancho Cucamonga Mello Roos assessment funds to construct Day Creek (Zone 1), and $1 million of assessment funds for Bledsoe Creek (Zone 3). The Budget also includes reimbursements received in FY 86-87 from the Department of Water Resources and FEMA totaling $2.6 million. Figure 19 summarizes the 87-88 fiscal year budget.

Figure 13

August 1987

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT

ZONE 1

LIST OF ULTIMATE REGIONAL FACILITIES
& PRIORITY SECONDARY STORM DRAINS

Length of Facility in Miles	Facility Name	Estimated Cost (Millions)	Remarks/Reach
5.0	W. Cucamonga Channel	18.1	Ely Basin to 15th Street Basin
1.7	West State St. Storm Drain	13.2	Supplement Existing Facility with Detention Basins and Inlet Storm Drains
	City Formula Priority Projects Ten Year Program	38.4	See Zone 1 10-Year Formula Fund Distribution Chart
	Total Program =	69.7 million	
Less 5 Year Construction Program		25.9 million	
		43.8 million	

SUPPLEMENTALLY FUNDED PARTICIPATION PROJECTS

9.0	Day Creek Project	40.0	Project Currently Under Construction
8.0	San Sevaine Water Project	42.1	Project Currently Under Study Includes Upper Reaches of Etiwanda Creek
		82.1	

Figure 14

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT

ZONE 2

LIST OF ULTIMATE REGIONAL FACILITIES

TO BE CONSTRUCTED

Length of Facility in Miles	Facility Name	Estimated Cost (Millions)	Remarks/Reach
3.3	Del Rosa Channel	12.0	Baseline to Daley Basin.
4.7	Rialto Channel	15.6	Santa Ana River to Cactus Basin.
2.3	Upper Warm Creek	10.2	Del Rosa Channel to Victoria Avenue.
1.5	Sand Creek Channel	6.6	Upper Warm Creek to Debr Basin (Canyon Mouth).
1.2	Little Sand Creek	5.0	Del Rosa Channel to Debr Basin (Canyon Mouth).
2.8	Cable Creek	15.5	Devil Creek Bypass Ch to Canyon Mouth.
4.0	City Creek	9.0	Twin Creek Channel to City Creek.
4.0	Santa Ana River	3.2	Riverside Drive to Mt. Vernon Avenue.
	Total Program =	$77.1 million	
Less 5 Year Construction Program		1.9 million	Initiate Program for Del Rosa & Rialto Channels Construction.
		$75.2 million	

Figure 15

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT

ZONE 3

LIST OF ULTIMATE REGIONAL FACILITIES

TO BE CONSTRUCTED

Length of Facility in Miles	Facility Name	Estimated Cost (Millions)	Remarks/Reach
5.0	San Timoteo Channel	25.1	Santa Ana River to San Timoteo Canyon Road
9.3	Mission Zanja Channel	50.4	Santa Ana River to Crafton
5.6	Wilson Creek Channel	22.4	I-10 to Wilson Basins
2.4	Wildwood Channel	10.6	I-10 to Debris Basin (Vicinity of Fremont)
	Total Program	$108.50 million	
	Less 5 Year Construction Funds Available	1.74 or 1.6% of required construction funding for regional projects (See note).	
		$106.81 million	

Note: Available funds for construction are insufficient to initiate even a minimal construction program along any of the required regional drains. It is recommended that all available construction funds be allocated on a yearly basis to major maintenance projects until such time as alternate funding for regional drains can be obtained. At that time, all or portions of these funds can be used to fund the local interests portion of the project.

Figure 16

January 1988

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT

ZONE 4

LIST OF KNOWN FACILITIES TO BE CONSIDERED FOR CONSTRUCTION

Facility Name	Estimated Cost (Millions)
Mojave River Floodway F.Y. 87/88 Projects	
Levee and Rock Slope Protection 4.3 miles	1.6
Mojave River Floodway Priority Levees	
Existing F.C.D. R/W with Earth Levee Requiring Rock Slope Protection 8.5 miles	3.2
Mojave River Floodway Levees	
Additional Areas Along Floodway Requiring Levee and Rock Slope Protection 66.1 miles	24.5
Priority Off River Projects	
Desert Knoll Wash - Mojave River to Apple Valley Rd.	1.0
Apple Valley Priority Drains	Pending Study Completion
Hesperia Priority Drains	Pending Study Completion
Victorville Priority Drains	Pending Study Completion
Desert Knolls Priority Drains	Pending Study Completion
Additional Off River Projects	
Dean Wash Project	1.4
Baker School Interceptor	.3
Oro Grande Wash	.8
Desert Knolls Wash - Apple Valley Road to Tau	1.8
Armory Channel	1.3
Mojave Drive Channel	1.1
Kitchen Wash Project	1.4
Victorville Wash #4	.6
Victorville Wash #3	.7
Holiday Wash Project	1.1
~~Broadway Channel~~	~~1.3~~
TOTAL	40.5 Plus Pending Costs
*Less 5-Year Construction Program	5.0
	35.5

*Not Including Planning and Engineering Funds

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT

ZONE 6

LIST OF FUTURE REGIONAL FACILITIES
TO BE CONSTRUCTED

	Est. Project Cost	5-Year Expenditures
WRIGHTWOOD AREA		
Swarthout Creek	$ 564,840	
ADELANTO AREA		
Adelanto East Channel	1,033,560	
Adelanto City Core Channel	1,902,960	
Adelanto Aster Road Channel	2,053,080	
TRONA AREA		
Cemetery-Borosolvay Improvements	492,480	
BIG BEAR AREA		
Rathbone Creek	1,008,720	
Van Dusen Creek	388,800	
Division Creek	912,600	
Lemon-Lily Creek	803,520	
Sawmill Creek	1,381,320	
Meadow View Creek	1,004,400	
VICTORVILLE AREA		
Mojave Drive Channel .(Zone 6 Ptn)	974,160	
Victorville Wash #3 .(Zone 6 Ptn)	1,134,000	
Victorville Wash #4 .(Zone 6 Ptn)	1,477,440	
LUCERNE VALLEY		
Lucerne Valley Channel	378,000	
Lucerne Valley West	295,920	
MORONGO VALLEY AREA		
Little Morongo Creek	800,000	$ 120,000
Big Morongo Creek	2,383,560	
YUCCA VALLEY-JOSHUA TREE AREAS		
Yucca Creek Channel (Incl. Water Canyon).	18,480,960	
Long-Hospital System (Interim Imp 700,000).	3,020,000	701,093
Old Woman Springs Wash	1,250,000	800,000
Covington Wash	1,993,680	
Joshua Wash (Reach's V, VI & VII $706,500).	2,015,000	726,700
Quail Wash	1,034,640	

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT

ZONE 6

LIST OF FUTURE REGIONAL FACILITIES
TO BE CONSTRUCTED

(CONTINUED)

	Est. Project Cost	5-Year Expenditures
29 PALMS AREA		
29 Palms Channel (Upgrade)	$ 7,529,760	
Pinto Cove Project	2,812,320	
Oasis Wash Project	1,422,360	
NEEDLES AREA		
Needles Riverview Project	443,880	
Needles Flood Channel Improvement (Upgrade)	1,421,280	
North Needles Basins & Roadrunner Wash	864,000	
Fox - Lemming Washes	1,706,400	
WONDER VALLEY		
Wonder Valley Channel	4,690,440	
NEWBERRY		
Newberry Levee	1,047,600	
ZONE 6 GENERAL		
Planning, Engineering and Major Maintenance		$970,000
C.S.D.P. PROJECTS	No Estimate	
Priority Drains	Pending Study Completion	$493,000 (Reserve)
TOTAL	$68,721,680	
LESS 5-YEAR CONSTRUCTION PROGRAM	3,340,793	
REMAINING ZONE 6 CONSTRUCTION FUNDS REQUIRED	$65,380,887	

3-8-88

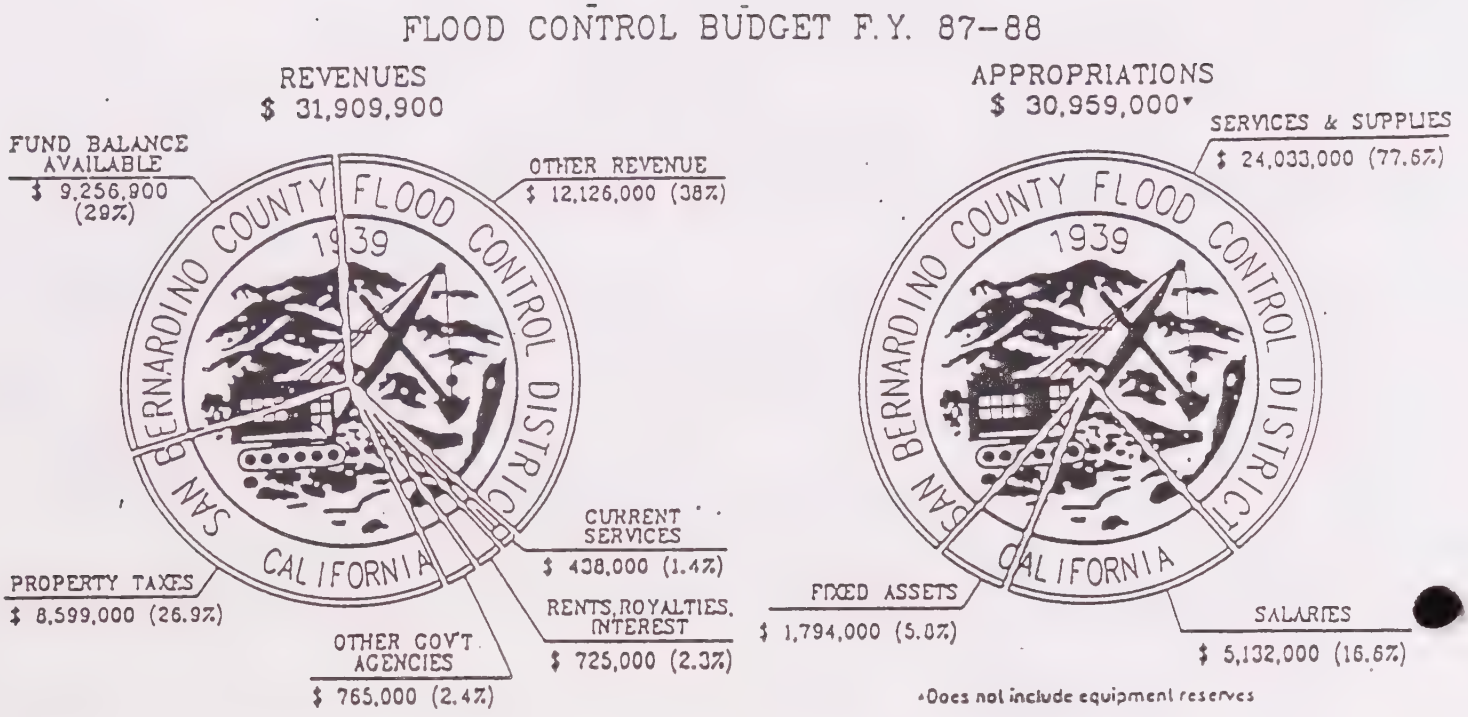
FLOOD CONTROL DISTRICT
PROPOSED 5 YEAR CONSTRUCTION PROGRAM

ZONE (BU 010 ONLY)	1988-89	1989-90	1990-91	1991-92	1992-93	TOTAL
1	7,451,683	3,062,500	3,391,500	3,815,500	4,327,500	$22,048,683
2	1,650,989	1,058,000	1,294,500	1,451,500	1,591,500	$7,046,489
3	145,532	224,500	332,500	391,000	493,000	$1,586,532
4	1,790,536	744,000	806,500	1,054,500	1,239,500	$5,635,036
5	210,007	40,000	52,000	66,500	67,500	$436,007
6	834,793	576,500	682,500	801,500	915,500	$3,810,793
TOTAL	12,083,540	5,705,500	6,559,500	7,580,500	8,634,500	$40,563,540

Figure 18

5yrconst

Figure 19



e. Flood Control District Existing Facilities

In addition to the Federally funded flood control facilities the Flood Control District, using its portion of local ad valorum tax monies, has developed a very extensive system of facilities, including dams, conservation and debris basins, levees, channels and storm drains to intercept and convey flood flows through and away from the major developed areas of San Bernardino County.

A summary of District facilities was tabulated by using the 1975 System Inventory Data and adding new projects as found by reviewing contract design estimates since 1975, and by reviewing other existing tabulations (O & M and Planning Section) and other information available, including the 1979-80 F.Y. Flood Control District R/W Report. This listing can be considered updated to July, 1980, and is the most current information available at this time. Figure 20 shows the Flood Control System in the Valley and Mountain planning areas.

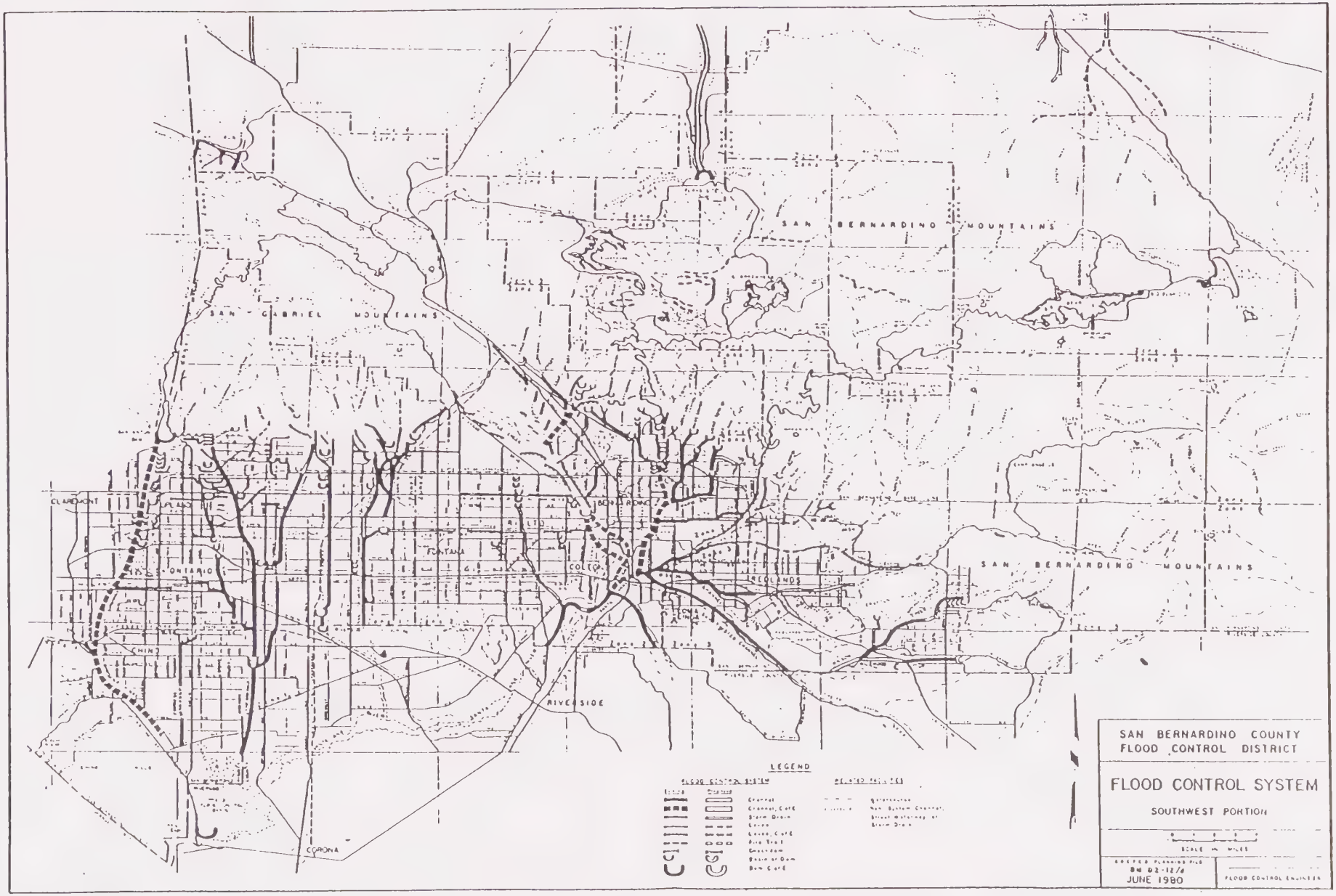

SAN BERNARDINO MOUNTAINS
SAN GABRIEL MOUNTAINS
SAN BERNARDINO MOUNTAINS
CLAREMONT
ONTARIO
MIRA LOMA
FONTANA
COLTON
REDLANDS
RIVERSIDE
CORONA
LEGEND
SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT
FLOOD CONTROL SYSTEM
SOUTHWEST PORTION
SCALE 1" = 2 MILES
DRAWING NO. 82-12/6
JUNE 1980
FLOOD CONTROL ENGINEER

Figure 20

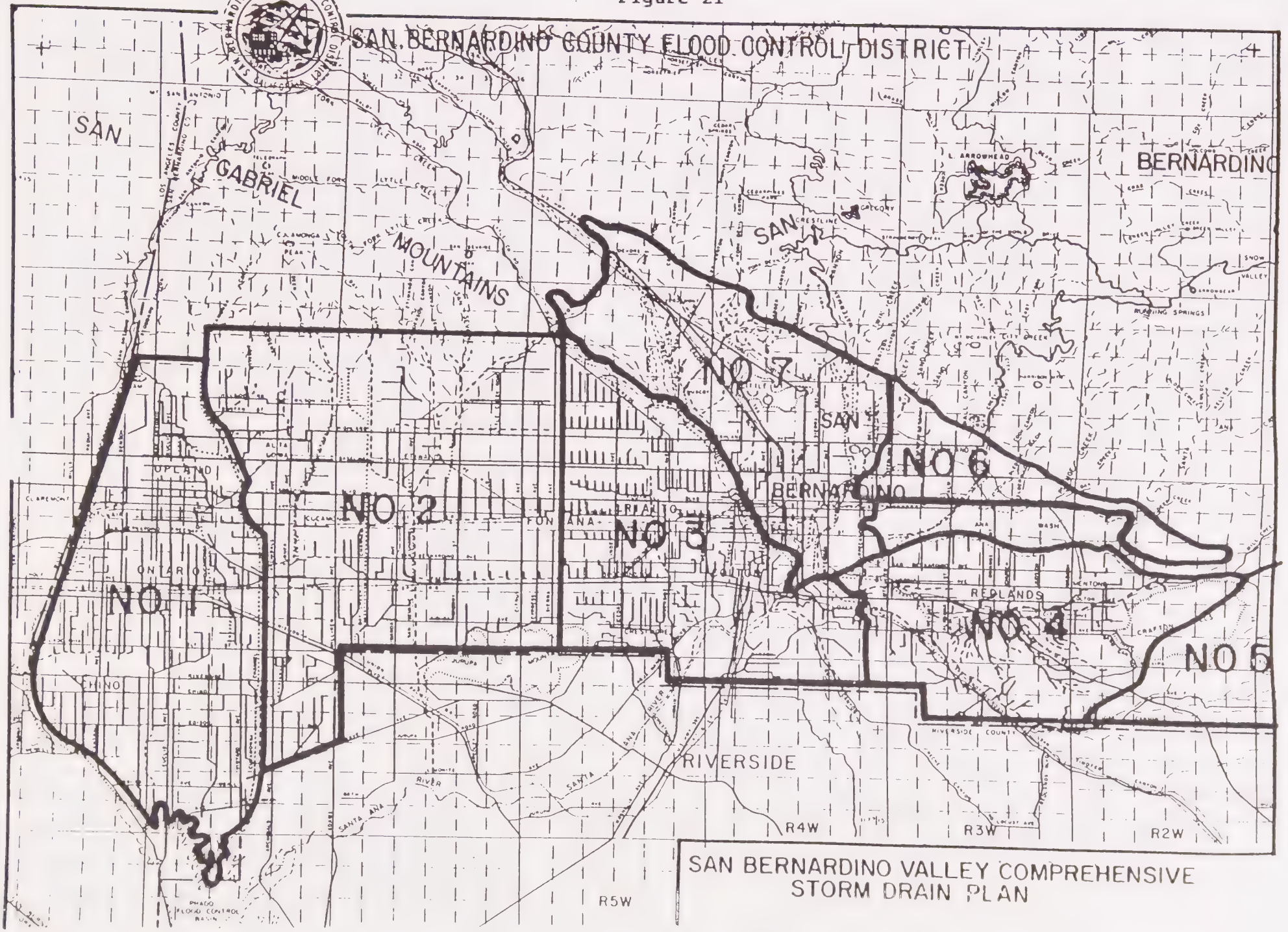
f. Flood Control District Master Plans/St
Plans

The Valley planning area has a Comprehensi
Drain Plan, which is shown in Figure 2
Valley area is subdivided into seven Compr
Storm Drain Plans areas, which provide a p
guide for the development of a compre
drainage system for secondary drains t
tributary to the major flood control ch
These plans provide for the overall stor
system and the general location, approx
slope, size, type and capacity of propose
drains within the system.

The limits to which the storm drain system
is a question of judgement involving both ec
and environmental considerations. In ge
storm drains are not planned where no devel
is planned, or where it can be shown that n
channels are adequate if properly protecte
erosion control measures or are stablized t
extent that further erosion will not c
Certain natural channels may be considered
in effect part of the storm drain syst
natural channels are in areas of poss
development where the natural channels are
defined and where installation of hardened ch
improvements would be detrimental to the aest
and environmental aspects of the area.

If development occurs, provisions for these char
might include analysis of capacity of nat
channel, easements or rights-of-way, minor cha
realignment, etc. It is important that nat
channels be protected from erosion. Measure
prevent erosion might be in the form of en
dissipators where concentrated flows are direc
into the natural channels, bottom controls, s
protection, debris basins, etc. These measu
may be required where any unusual amounts
transporting debris may plug drainage faciliti
thereby increasing risks of downstream floodi
Even though the above and other channel eros
control techniques short of total hardening
used, some degree of debris production can occ
and rearrangements for channel facility maintenar
may be required. The formation of property owner

Figure 21


SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT
SAN GABRIEL MOUNTAINS
SAN BERNARDINO
NO 1
NO 2
NO 3
NO 4
NO 5
NO 6
NO 7
ONTARIO
UPLAND
FONTANA
REDLANDS
RIVERSIDE
SANTA ANA RIVER
CHINO
R5W
R4W
R3W
R2W
SAN BERNARDINO VALLEY COMPREHENSIVE
STORM DRAIN PLAN

associations or other agreements may be necessary providing for maintenance of drainage and debris basin facilities.

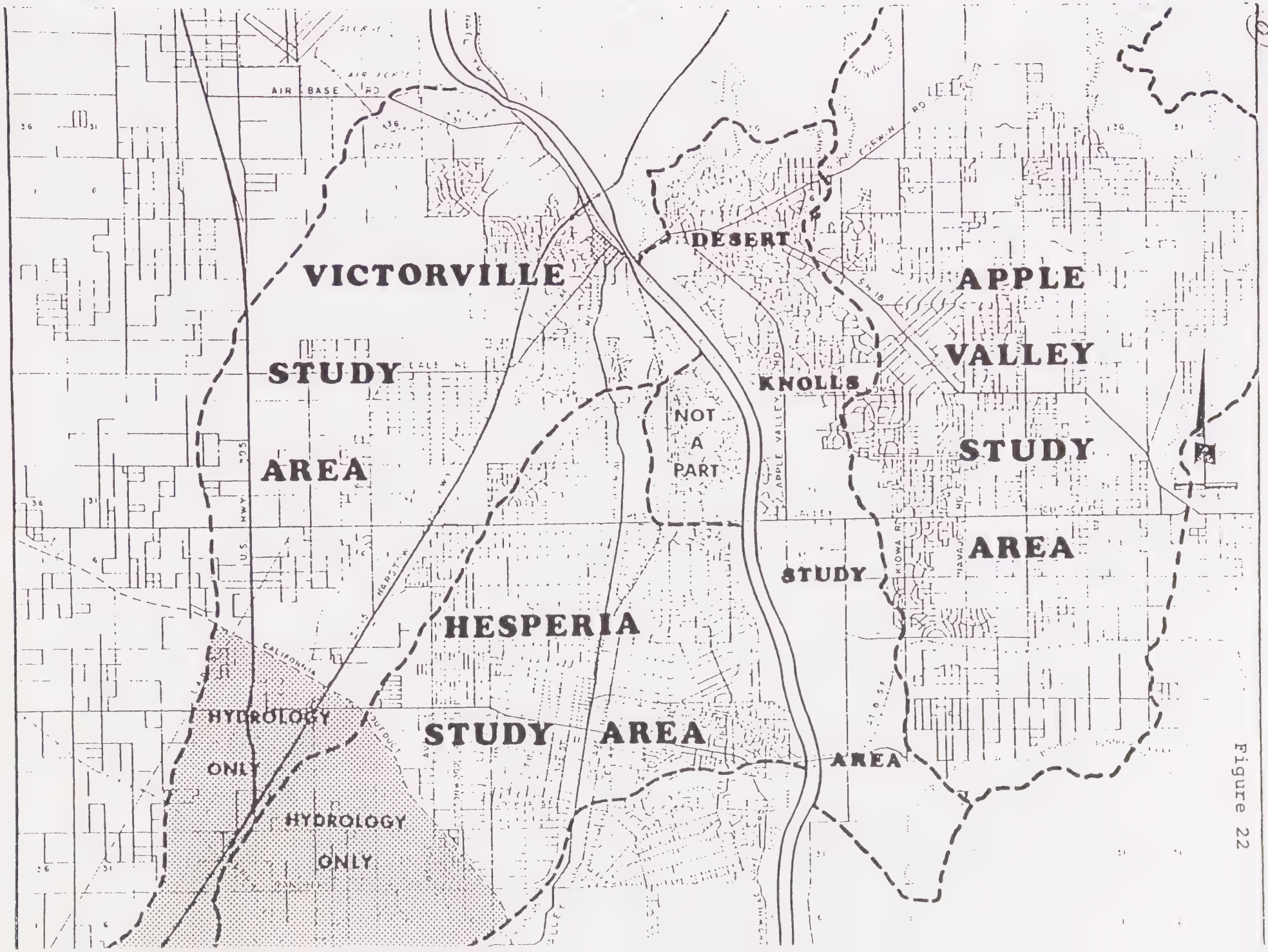
Many drainage courses which will have to be retained, as natural channels have not been identified on the plans. The above comments would also apply to these unidentified natural drainage watercourses.

In addition to the Valley planning area, the Flood Control District has Drainage Master Plans for the following areas:

Morongo Valley	Joshua Tree
Twentynine Palms	Wonder Valley
Big River	Needles
Baker	Trona
Daggett-Newberry	Barstow
Victorville	SwarthoutValley
Big Bear	(Wrightwood)
Lucerne Valley	Crest Forest

The above Master Plans are conceptual and subject to change if and when detailed Master Plans are undertaken.

In the Victor Valley area of the North Desert, a consultant is currently preparing Drainage Master Plans for Apple Valley, Hesperia, Desert Knolls, and Victorville. Figure 22 indicates the study areas for these Master Plans. The VVIEP study, referred to earlier in this section, intends to establish the adequacy of existing facilities and project future facility needs; however, the VVIEP study will have to utilize information in the Drainage Master Plans to proceed with their analysis. The VVIEP Draft Engineer's Report, March 1988, includes some preliminary area drainage costs on a per acre basis ranging from $2,396 to $5,171. This range of costs was estimated from area drainage plans done for projects in the Victor Valley and other areas in San Bernardino and Riverside Counties. Per acre preliminary cost estimates were developed for the Adelanto area, Phelan/Pinon Hills, Oak Hills, and Baldy Mesa, which amounted to $4,250 per acre. Preliminary cost estimates for the Victorville area, Hesperia area, and Apple Valley were $5,250 per acre. The drainage cost for the entire area amounted to $1,335.26 million. Figure 23 shows the breakdown


VICTORVILLE
STUDY
AREA
DESERT
KNOLLS
APPLE
VALLEY
STUDY
AREA
NOT
A
PART
HESPERIA
STUDY AREA
HYDROLOGY
ONLY
HYDROLOGY
ONLY
AIR BASE RD
CREWIN RD
SH 18
APPLE VALLEY RD
MIOWA RD
NAVAJO RD
U.S. HWY 395
HARPER
CALIFORNIA
AVE
AVE
AVE

PROJECTED DRAINAGE COSTS

IPA #	DRAINAGE IMPROVEMENT AREA	UNIT COST	QUANTITY	DRAINAGE COST
1.	ADELANTO AREA	$4,250 /ACRE	25684 ACRES	$109,157,000
2.	PHELAN/PINON HILLS	$4,250 /ACRE	51341 ACRES	$218,200,950
3.	OAK HILLS	$4,250 /ACRE	26935 ACRES	$114,475,238
4.	BALDY MESA	$4,250 /ACRE	14106 ACRES	$59,950,500
5.	VICTORVILLE AREA	$5,250 /ACRE	28543 ACRES	$149,849,438
6.	SPRING VALLEY LAKE (1)			
7.	HESPERIA AREA	$5,250 /ACRE	27172 ACRES	$142,652,475
8.	APPLE VALLEY	$5,250 /ACRE	101513 ACRES	$532,942,200
	MOJAVE RIVER MASTER PLAN (2)	$65 /LF	123622 LF	$8,035,443
	TOTAL			$1,335,263,243

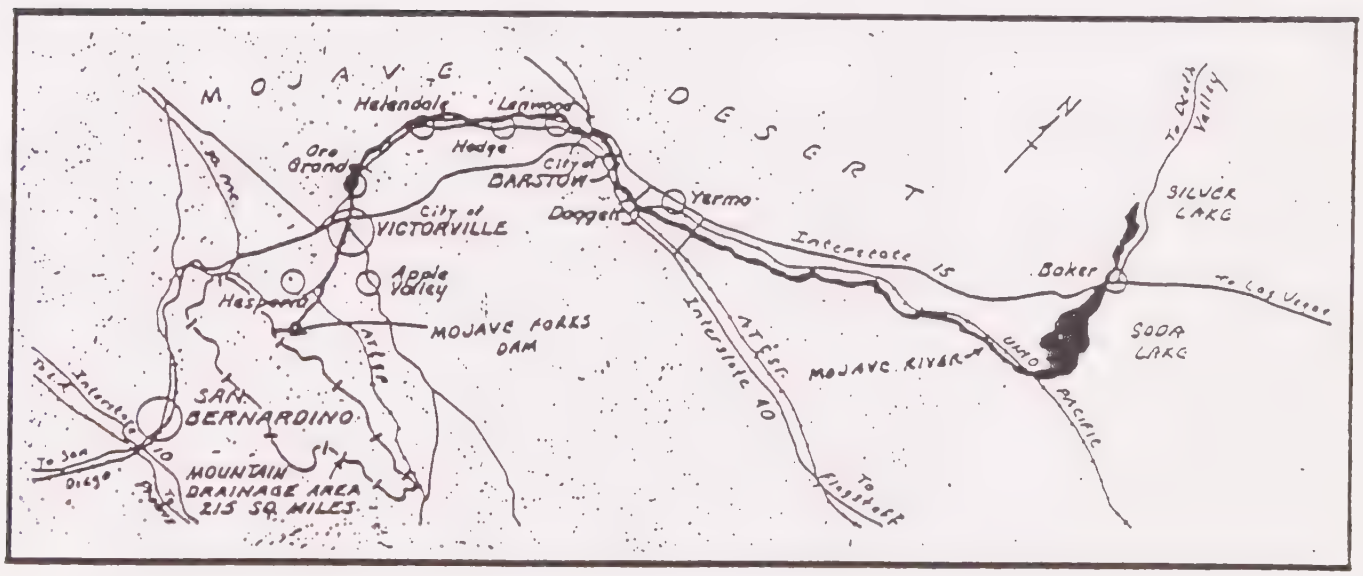
NOTE:

1. DRAINAGE INFRASTRUCTURE ALREADY CONSTRUCTED
2. ROCK FACED LEVEES

Source: V.V.I.E.P. Draft Engineers Report, NBS/Lowry

Figure 23

of these preliminary cost estimates. The Mojave River, located in the County's North Desert planning area, has headwaters originating on the Northern slopes of the San Bernardino mountains. The tributary mountain watershed to canyon mouth is 215 square miles. Figure 24 shows the Mojave River. The Mojave Forks Dam, located at the canyon mouth was constructed by the Corps of Engineers in 1971 and has an ungated outlet that will pass 23,500 cfs. in a major storm. This large outlet flow was necessary to assure continued groundwater recharge in the lower reaches of the river basin. Downstream from the Forks Dam the river flows a natural 96 mile long meandering alignment to its terminus at the Soda Dry Lake. When full the Soda Lake will overflow into Silver Dry Lake located near the community of Baker.



Mojave River Figure 24

The Flood Control District has pursued a program of floodway designation and confinement by means of rock face levee construction at critical locations along the upstream reaches of the Mojave River. To date, it has been determined the lower reaches of the river from Daggett-Yermo Road through Afton Canyon and into the Dry Lakes shall remain in its natural state and no improvement is planned. Encroaching urbanization and development

in recent years have necessitated increased flood control planning and levee construction along the designated floodway on the upper portion of the river.

County staff recently prepared a master plan (January 1988) for improvement of the Mojave River, as shown in Figure 25. This master plan identifies 66.1 miles of rock faced levees required along the river's course. It is anticipated that these will be constructed for the most part after 1992.

g. Bledsoe Creek Local Area Drainage Plan

The Board of Supervisors approved the Bledsoe Creek Local Area Drainage Plan (Figure 26) in the Highland area in July 1985, and authorized the formation of an assessment district in October 1986, to provide for improvements in the Bledsoe Creek watershed. The assessment district construction project will include the improvement of Bledsoe Creek from Boulder Avenue on the west, to Streater Drive (formerly Railroad Street), and the construction of a storm drain north from Bledsoe Creek along Streater Drive, to the intersection of Baseline and Browning Road, thence a storm drain easterly on Baseline for approximately 1500 feet.

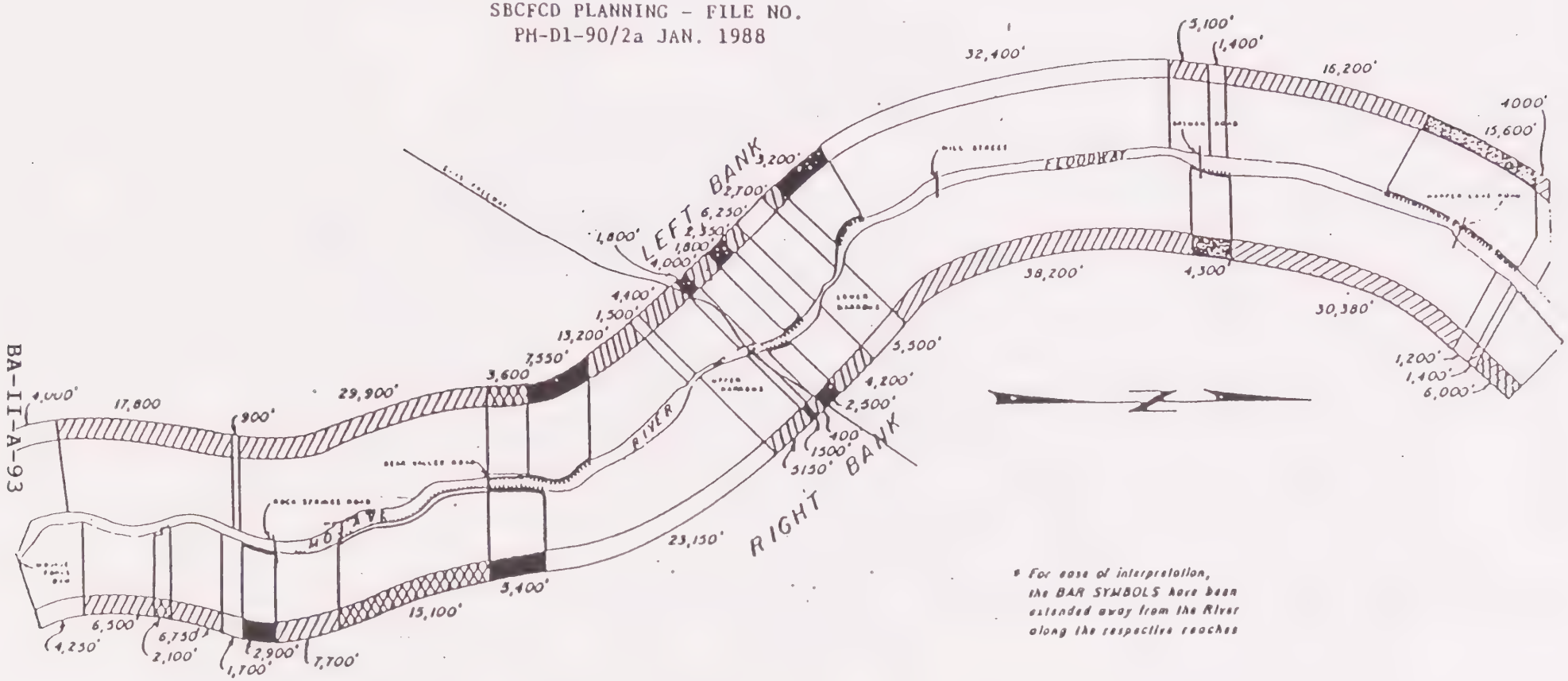
Plans and specifications for this project have been completed. The completed construction will provide the backbone drainage system for the Bledsoe Creek watershed. The system will provide both flood protection and an outlet for drainage that will enable the watershed to be developed in an orderly manner.

The Local Area Drainage Plan fees in Ordinance No. 2951, which was approved July 22, 1985, amount to $5,700 per acre. At this time the Bledsoe Creek Local Area Drainage Plan is the only such plan in the County, although other areas are being considered. The County Development Code, in Division 13, Public Facilities Financing, authorizes Local Area Drainage Plans in Chapter 2, Drainage Facilities.

SCHEMATIC MASTERPLAN MAP OF MOJAVE RIVER

Delineating the Improvement Status of Various Reaches

SBCFCD PLANNING - FILE NO.
PH-D1-90/2a JAN. 1988



BA-II-A-93

* For ease of interpretation, the BAR SYMBOLS have been extended away from the River along the respective reaches

MOJAVE RIVER LEVEE REQUIREMENTS
SHEET I

BAR SYMBOL	STATUS
	EXISTING ROCK FACE LEVEES
	HIGH BANK - No Levees Required
	REQUIRING ROCK FACE LEVEE
	EXISTING EARTH & ROW REACHES Possible Priority One Locations for Rock Face Levees

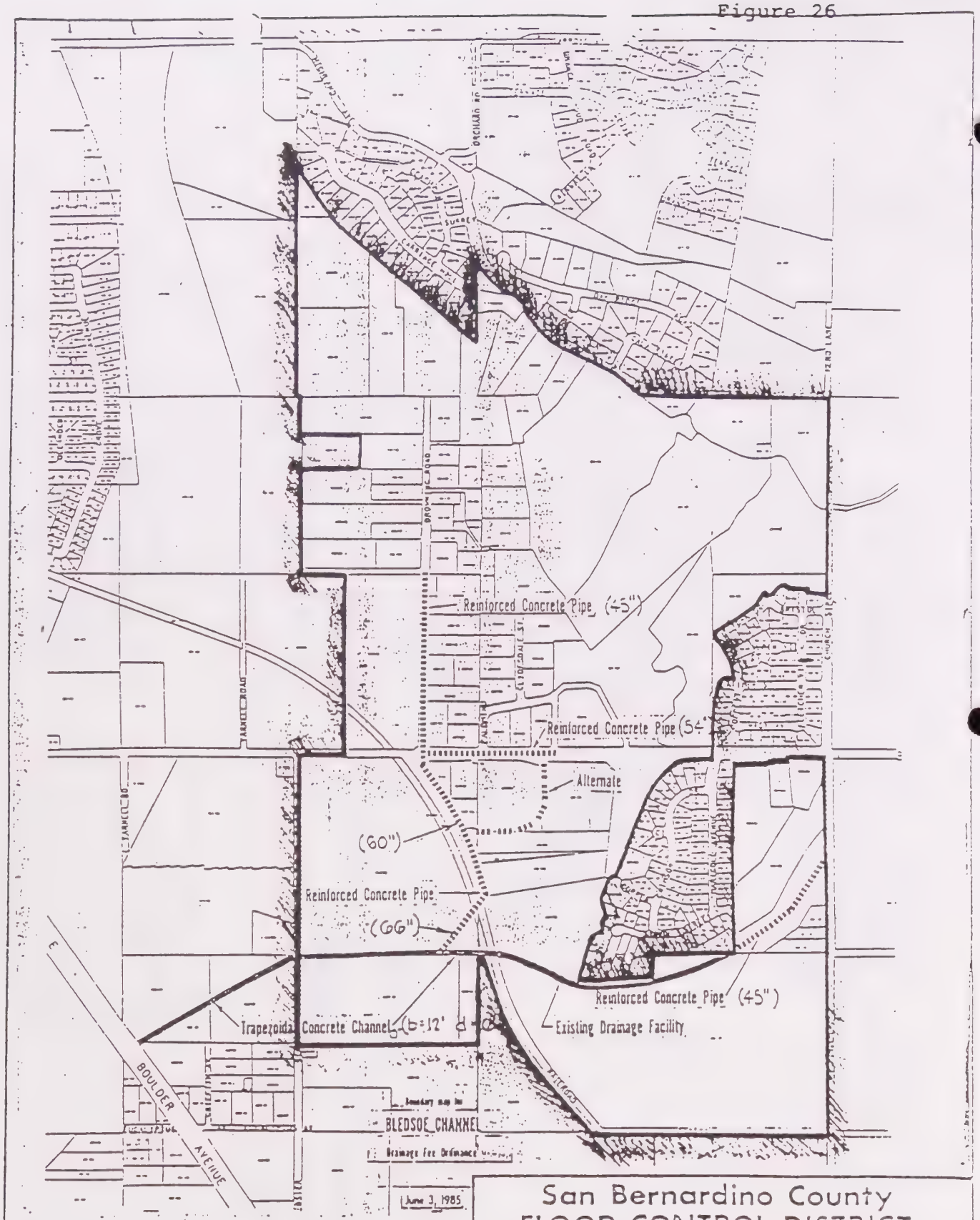
LEGEND

- FCD Designated Mojave River Floodway
- TYPE "A" - Rock & Wire Revetment only
- TYPE "B" - Earth Levee Only
- TYPE "C" - Earth Levee with Rock & Wire Revetment
- TYPE "D" - Rock Faced Levee with Rock & Wire Revetment
- Rock Faced Levee

See SBCFCD Planning File No RM-D6-3/3 for Typical Section

Figure 25

Figure 26



Plan View & Boundary Map

San Bernardino County
FLOOD CONTROL DISTRICT

BLEDSOE CREEK
LOCAL AREA DRAINAGE PLAN

DATE	SCALE	DRAWING NO.
6-85	1" = 1000'	1 of 5

h. Mission-Zanja System (Redlands Area)

In cooperation with the City of Redlands, the Corps of Engineers is progressing with plans for construction of a 1.4 mile project through the downtown portion of the city. This $9.2 million project is funded under the Corps small project allocations, with the city RDA picking up the excess costs over $4 million. The remaining Zanja System has long been a serious flood threat to major portions of Zone 3. Now, more than ever, because of the rapid development and growth in previously agricultural areas, the need for this project is being recognized.

In May, 1987 steering and gechnical review committees were formed to (1) evaluate what regional drainage improvements should be provided within the Mission-Zanja watershed, and (2) determine what methods of financing should be used to provide the selected improvements. The Cities of Redlands and Loma Linda, County of San Bernardino, County Service Area 110, and private property owners are represented on the committees. The goal of the communities is to develop and fiance a drainage plan that will provide 100 year flood protection and will be aesthetically and environmentally acceptable to the public.

The initial plan consisted of (1) a detention basin on the Zanja at Opal Avenue, (2) hardlining the existing Mission Channel and the Zanja with reinforced concrete or rock, (3) realignment of Morey Arroyo to confluence with Mission Channel upstream of Alabama St., (4) intercepting the major portion of the Zanja flows at Lincoln Street, and conducting them along the Southern Pacific Railroad back to the Zanja at I-10 and (5) major storm drain laterals to Mission Channel and the Zanja. The total cost was estimated at $33,000,000. Based on the developable area within the watershed, a development fee of $6,300 per acre would be necessary to finance the project.

Under contract with the District, the firm Metcalf & Eddy is developing a plan and profile, alternate channel sections, and related cross sections for various reaches of Mission Channel and the Zanja. The technical review committee will select the type of channel improvement for each reach based on cost, protection provided, aesthetics, and regional needs. These improvements will become

part of the recommended plan submitted to the steering committee. Also, the District has contracted with Sutro & Company to develop alternate funding mechanisms to implement the recommended drainage plan for the Mission Channel and Zanja watershed. Upon the steering committee selecting a recommended financing plan, the recommended drainage and financing plan will be presented to the appropriate city and county governing bodies for approval and implementation.

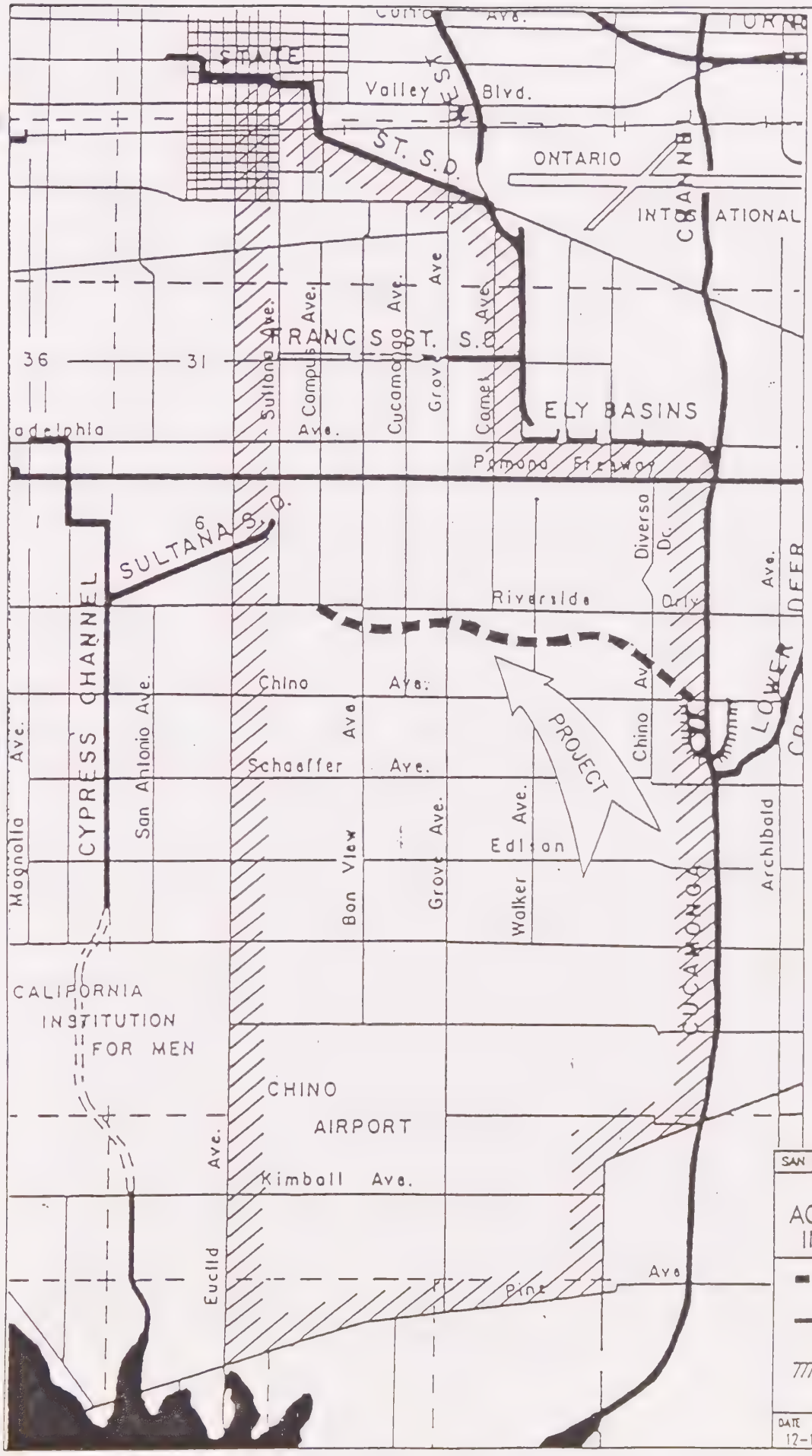
i. Chino Agricultural Preserve Interceptor Channel

The proposed Chino Agricultural Preserve Interceptor Channel will consist of the construction of approximately 2.3 miles of trapezoidal earth channel and the construction of six reinforced box culverts at road crossings. This project will provide 100-year flood protection for a major portion of the Chino Agricultural Preserve, an area of approximately 13,600 acres, located in the unincorporated area of the County easterly of the City of Chino. Figure 27 shows this proposed project.

In 1980, the County of San Bernardino undertook a comprehensive study of the dairy industry in the westerly portion of the County. The purpose of this study was to look at the long term problems facing the industry due to the rapid urbanization surrounding the dairies in the cities of Chino and Ontario. One of the conclusions of this dairy study was that a means of protecting the Chino Agricultural Preserve from the uncontrolled drainage flows being generated in approximately 4,000 acres of upstream urbanized area was necessary for successful operation of the dairies and agricultural land uses. Subsequently, an agreement was entered into between the County and the State Water Resources Control Board for a study under Section 205(j) of the Water Quality Management Planning Program. This study was completed in April, 1987.

The recommended drainage solution by this study was to construct an earth swale that would intercept north-south storm flows and convey them easterly into improved water spreading basins, known as the Lower Cucamonga Spreading Grounds. As well as providing necessary flood protection for the Agricultural Preserve, the swale will serve to

Figure 27



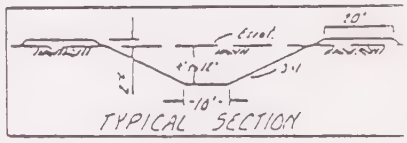
TRAPEZOIDAL EARTH SWALE INTERCEPTOR

100 year protection
$7,500,000

Comments:

Provides 100-year protection from flows generated north of Riverside Drive. Does not provide for flows generated within the preserve.

Proposal consists of trapezoidal earth (grass lined) channel with box culverts at road crossings. Dual use of channel may be possible. This is not an ultimate solution, but would provide an interim solution as long as the preserve remains.



SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT

CHINO AGRICULTURAL PRESERVE INTERCEPTOR CHANNEL

PROPOSED FACILITIES

EXISTING FACILITIES

STUDY AREA BOUNDARY

DATE	DRAWN BY	ACAD FILE	S.B.C.F.C.D. PLANNING FILE #
12-1-87	B.H.		PM-01-106

preclude the mix of urban flood runoff and dairy waste which will further degrade the Chino Groundwater Basin. Construction of the swale will allow the dairymen to handle their wastes economically and in a manner approved by the State Water Quality Control Board.

The cost estimate for the design and construction of this interceptor channel, including road culvert crossings and acquisition of right-of-way, is $7.5 million. The County of San Bernardino has submitted a loan application to the California State Water Resources Control Board in an effort to obtain financing for the channel construction through a low interest loan arrangement under the "Water Conservation and Water Quality Control Bond Law of 1986". The State Water Resources Control Board is in receipt of the application for this project and is presently reviewing it, along with other projects statewide.

j. County Detention Basin Draft Policy

With the increase in land values and the reduction of available flood free land, the use of detention basins for flood protection as an interim measure or as part of the ultimate drainage facilities needs to be evaluated. To determine if detention basins could be an appropriate means of providing flood protection, the County hired a consultant engineer to study the problem and provide a report on which to base future policy.

The ultimate solution is to eliminate flooding through structural measures (e.g. channels, storm drains, dams, etc.). Additionally, since the County is a participant in the National Flood Insurance Program and has adopted floodplain regulations, new development must be constructed in a manner which does not adversely affect adjacent or downstream properties. Since master plans facilities are usually expensive and time consuming to implement, interim techniques such as detention facilities need to be considered in order to mitigate new downstream impacts and allow development to proceed. The County is currently developing a detention basin policy, a detention basin maintenance financing policy, and a detention basin submittal procedure, all of which are tentative at this time.

k. Federal Flood Control Program

The Flood Control District has worked with the Federal Government and the Army Corps of Engineers to develop the existing system of ultimate design Federally funded major outlet flood facilities.

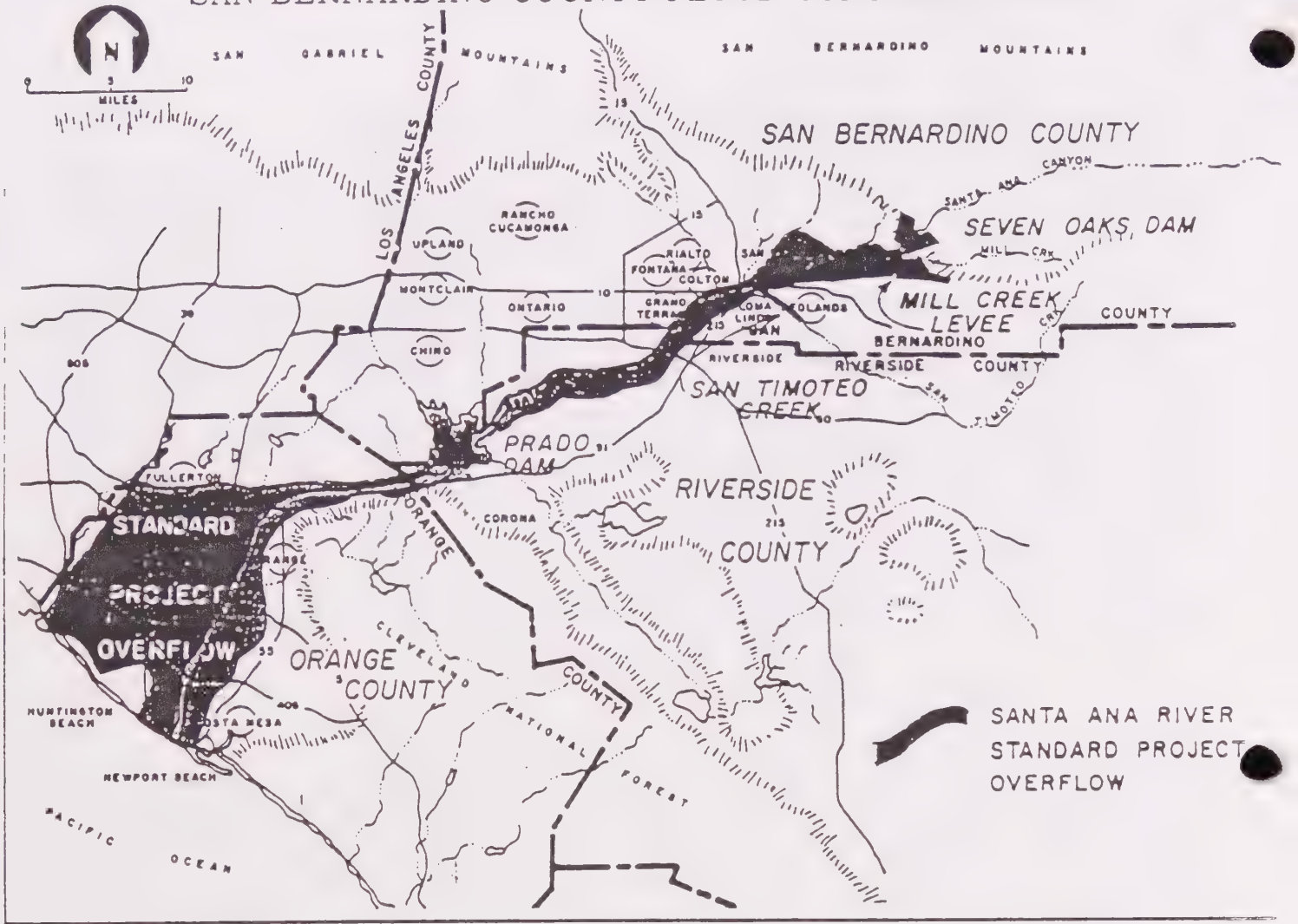
The Flood Control District is responsible for administering the local interest portion of the Federal Corps of Engineers-Flood Control District contracts. This includes coordinating the required right-of-way, relocating utilities, road and bridges, and local drainage construction with the Corps of Engineers, contractors, utility companies and other agencies; coordinating with the State of California, Department of Water Resources in financing reallocation programs for Federal flood control projects; coordinating with the Corps of Engineers in the surveying, planning and engineering of projects; supervising funding of Federal projects with respect to local, State and Federal funding.

i. Santa Ana River Mainstem

The Santa Ana River Mainstem ("All River Plan") involves the Counties of San Bernardino, Riverside, and Orange and a populous of approximately two million people who are continuing to face a severe threat of flooding from the Santa Ana River. The Corps of Engineers has determined that flooding of this river could cause an estimated $12 billion in damage and loss of life in a severe flood. The Santa Ana River Mainstem Project ("All River Plan") would provide for much needed flood protection through the construction of improvements including the Seven Oaks Dam, Mill Creek Levees, and the San Timoteo Creek Channel in the upper Santa Ana River, and downstream improvements including the enlargement of Prado Dam, Oak Street Drain, Santiago Creek and thirty two miles of the Santa Ana River Channel from Prado Dam to the Pacific Ocean. In addition, the counties of Riverside and San Bernardino would provide necessary flood plain management along approximately 30 miles of river between two dams. Figure 28 show the area covered by this project and the San Bernardino County elements.

Figure 28

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT



MAP OF
SANTA ANA RIVER MAINSTEM STANDARD PROJECT OVERFLOW
IN THE CALIFORNIA COUNTIES OF SAN BERNARDINO, RIVERSIDE, AND ORANGE

SANTA ANA RIVER MAINSTEM PROJECT – "ALL RIVER PLAN"

ULTIMATE GOAL	REQUIRED ACTION/SCHEDULE		COST
Reduce major flooding along the Santa Ana River within three Southern California Counties.	FY 88/89	a) Continue Pre-Construction Engineering and Design for the entire Mainstem Project.	$ 6,700,000
		b) Initiate Right of Way Acquisition, including lands for Fish and Wildlife enhancement at mouth of Santa Ana River.	$ 6,300,000
		c) Construct a test fill at Seven Oaks Dam site.	$ 1,900,000
		d) Complete project study for San Timoteo Creek.	$ 100,000
	REQUIRED FY 88/89 FUNDS FOR SANTA ANA RIVER MAINSTEM		$15,000,000

SAN BERNARDINO COUNTY ELEMENTS OF SANTA ANA RIVER MAINSTEM PROJECT

SEVEN OAKS DAM

ULTIMATE GOAL:

Complete Dam and Reservoir construction by FY 94/95.

REQUIRED ACTION/SCHEDULE:

FY 88/89 Initiate construction of test fill at dam site.

MILL CREEK LEVEES

ULTIMATE GOAL:

Design modifications to existing substandard levees and complete construction by FY 92/93.

REQUIRED ACTION/SCHEDULE:

FY 88/89 Initiate design of levee modifications.

SAN TIMOTEO CREEK

ULTIMATE GOAL:

Construct 5.1 miles of channel improvements to provide protection from serious flooding in San Bernardino County and the cities of Redlands & Loma Linda.

REQUIRED ACTION/SCHEDULE:

FY 88/89 Complete project study commenced during FY 87/88.

PRADO DAM

ULTIMATE GOAL:

Complete construction of Dam and Reservoir enlargements by FY 97/98.

REQUIRED ACTION/SCHEDULE:

FY 88/89 Initiate right of way acquisition. Review recreation alternativ

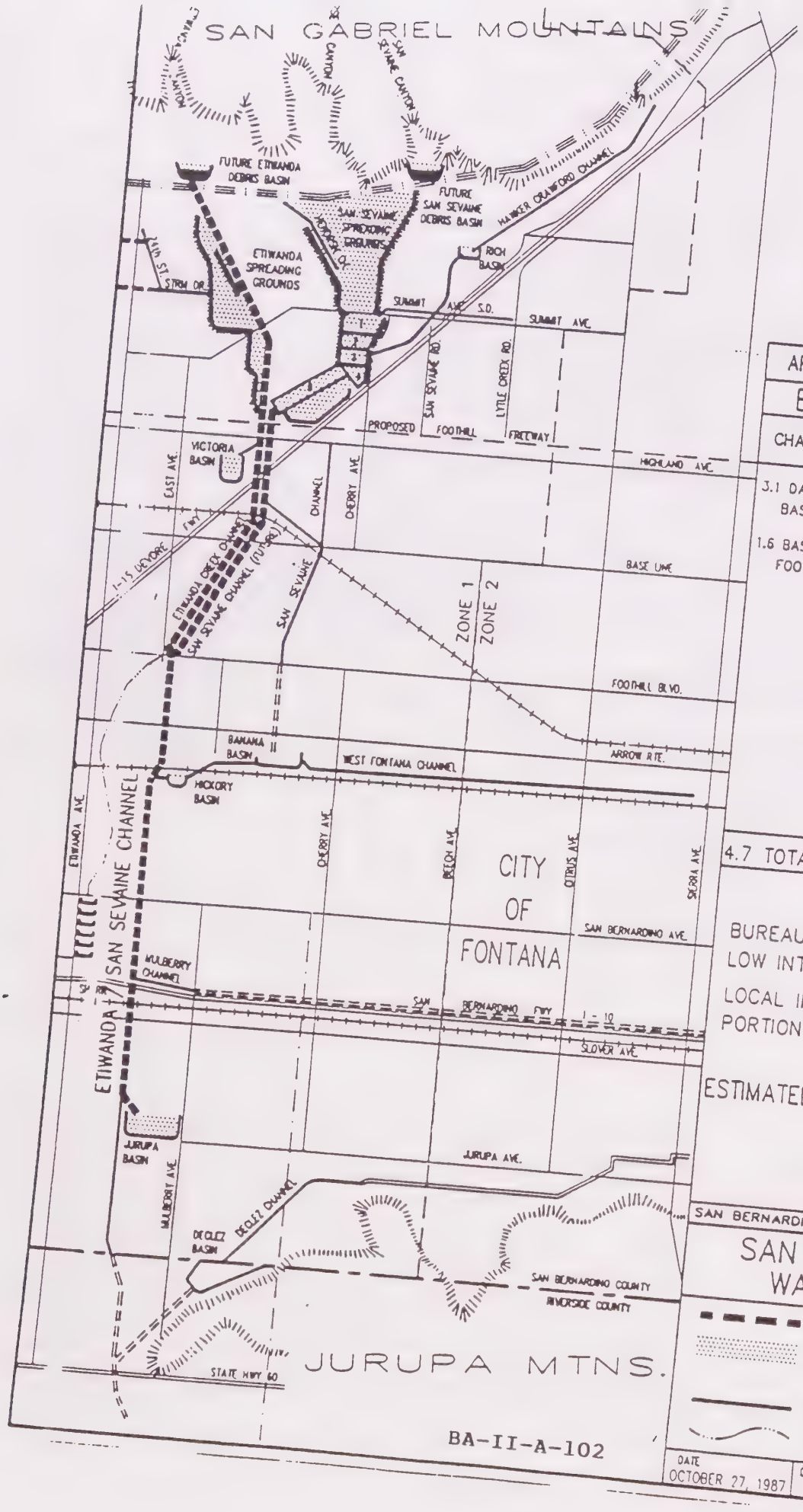
Funding in the amount of $15 million is currently included in the President's budget. This would allow for initiation of construction for the Seven Oaks Dam, commencement of right-of-way acquisition for enhancement lands, completion of study for San Timoteo Creek, and the continuation of project engineering and design.

On April 4, 1988, the California Water Commission voted support of this project, which is summarized below.

PROJECT AUTHORIZED:	Public Law 94-587, Section 109, Approved October 22, 1976 Public Law 99-662, Water Resources Development Act of 1986
TOTAL PLANNING AND ENGINEERING COST:	$26,100,000
TOTAL PROJECT COST:	$1.29 billion-includes $354 million local share
STATE OF CALIFORNIA COMMISSION RECOMMENDATION Fiscal Year 1988/89:	$15,000,000
PRESIDENT'S BUDGET Fiscal Year 1988/89	$15,000,000
REQUIRED ACTION:	Approval of $15,000,000 by Appropriation Committees and Congress

ii. San Sevaine Creek and Day Creek Projects

There is also substantial federal involvement in two current major flood control projects, both in the County's West Valley planning area. The federal Bureau of Reclamation is providing low interest loans to finance major portions of the San Sevaine Creek Water Project and the Day Creek Water Conservation and Flood Control Project. The following pages contain Figures 29 through 32 showing maps and summary descriptions of these two major projects. Both of this projects combine flood control with groundwater recharge. The



APPROXIMATE COSTS IN MILLION DOLLARS			
ETIWANDA		SAN SEVAINE	
CHANNEL	WATER CONSERVATION	CHANNEL	WATER CONSERVATION
3.1 DAM TO BASINS 1.6 BASINS TO FOOTHILL	3.2 DAM .3 SPREAD. GROUNDS .1 VICTORIA BASIN	5.9 U/S OF FOOTHILL 3.3 FOOTHILL TO SFRR 5.4 SFRR TO I-10 FWY 1.8 I-10 FWY TO JURUPA	8.2 DAM 1.7 SPREAD. GROUNDS .1 RICH BASIN 1.6 BASINS 1-4 3.0 BASIN 5 .7 HICKORY BASIN 2.0 JU BASIN
4.7 TOTAL	3.6 TOTAL	16.4 TOTAL	17.3 TOTAL

BUREAU OF RECLAMATION
LOW INTEREST LOAN $28,100,000
LOCAL INTEREST PORTION $14,000,000

ESTIMATED GRAND TOTAL $42,100,000

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT

SAN SEVAINE CREEK WATER PROJECT

- PROPOSED FACILITIES
- PROPOSED WATER CONSERVATION FACILITIES
- EXISTING FACILITIES
- NATURAL DRAINAGE COURSE

DATE	DRAWN BY	ACAD FILE	S.B.C.F.C.D. PLANNING FILE NO.
OCTOBER 27, 1987	D.F.	PESSBUM	PM-01-92/blm

BA-II-A-102

SAN SEVAINE CREEK WATER PROJECT
BUREAU OF RECLAMATION

PROJECT DESCRIPTION

The proposed San Sevaine Creek Water Project is a Bureau of Reclamation "Small Project" under PL 84-984. The project will consist of dams, spreading grounds, basins, turnouts and connecting channel systems. This project will provide water conservation measures and help attenuate flooding conditions in a drainage area of approximately 14 square miles within the cities of Fontana, Rancho Cucamonga, and Ontario as well as San Bernardino and Riverside Counties. There will be an average of approximately 25,000 acre feet per year of conservable runoff from the Etiwanda and San Sevaine Creeks tributaries in the project area. This water conservation aspect will be of benefit to approximately 14,000 acres of agricultural preserves in the Chino Groundwater Basin, which basically surrounds the project area. Withdrawals from the basin have averaged approximately 150,400 acre-feet per year over the past ten years. The Chino Basin Watermaster has inaugurated a program of groundwater replenishment by purchasing imported water. Because the water percolation basins and runoff storage basins proposed in this project overlie the Chino Groundwater Basin, the 25,000 acre-feet of conservable runoff in the form of groundwater percolation will aid in recharging the underground basin.

The project more specifically will consist of:

1. Etiwanda Channel and Debris Dam.
2. San Sevaine Creek Dam and Basin/Channel System from Summit Avenue to I-10.
3. Expansion and improvements to San Sevaine and Lower San Sevaine, Hickory, Jurupa, and Rich Basins.
4. Turnouts into Lower San Sevaine, Etiwanda Spreading Grounds, and Victoria, Hickory and Jurupa Basins.

PROJECT COSTS AND FUNDING

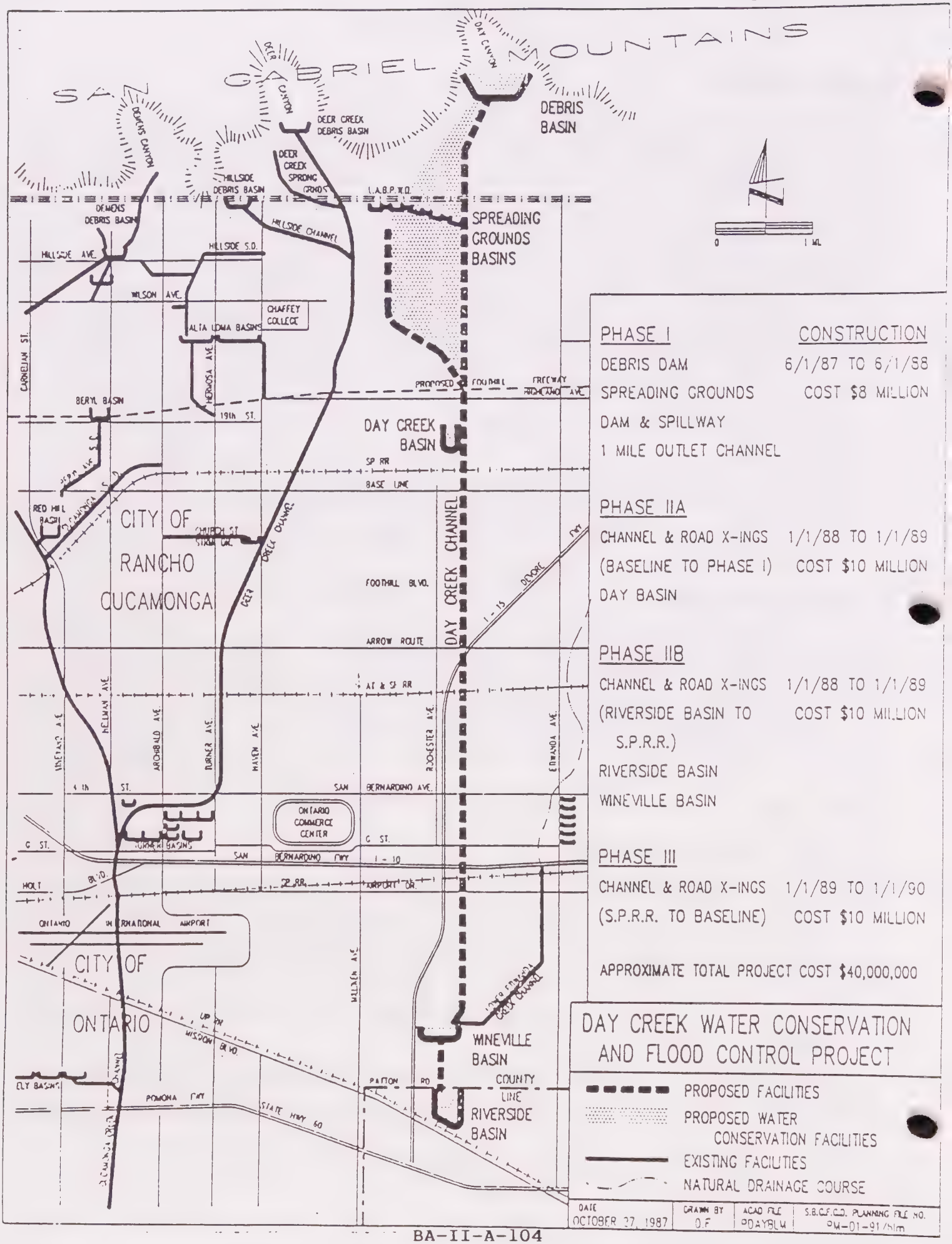
The basic estimate for the project is $42.1 million comprised of $28.1 million of Bureau of Reclamation low interest loan and $14.0 million local funding. Approximately 32.24% of the loan is designated as agriculture. It is anticipated that the agriculture percentage will be a non-interest bearing portion of the total loan. No portion of the project is covered under a grant, and no grants are perceived in the future. The project costs are to be repaid to the Government by various funding mechanisms supported but still undetermined by the Cities of Fontana, Ontario and Rancho Cucamonga, with the County of San Bernardino as lead agency.

PROJECT STATUS

The project has been under intense study by the local agencies for the major part of the past decade. The Bureau of Reclamation has been involved for several years. The local agencies have hired a consultant, and the PL 84-984 Loan Application Report (LAR) and Environmental Assessment Report (EAR) are completed. The LAR is programmed to be submitted to the Commissioner of Reclamation in late 1987. Although construction is scheduled in the LAR to start in October 1988, approximately $3 million of construction has already been completed with local funds. It is also anticipated that the remaining local funding portion ($14.0 million) will be completed by October 1988.

REQUEST FOR ASSISTANCE

REQUEST ASSISTANCE IN OBTAINING APPROVAL OF THE LOAN APPLICATION REPORT AND FUNDING FOR THIS PROJECT.



PHASE I — CONSTRUCTION

DEBRIS DAM — 6/1/87 TO 6/1/88

SPREADING GROUNDS — COST $8 MILLION

DAM & SPILLWAY

1 MILE OUTLET CHANNEL

PHASE IIA

CHANNEL & ROAD X-INGS — 1/1/88 TO 1/1/89

(BASELINE TO PHASE I) — COST $10 MILLION

DAY BASIN

PHASE IIB

CHANNEL & ROAD X-INGS — 1/1/88 TO 1/1/89

(RIVERSIDE BASIN TO S.P.R.R.) — COST $10 MILLION

RIVERSIDE BASIN

WINEVILLE BASIN

PHASE III

CHANNEL & ROAD X-INGS — 1/1/89 TO 1/1/90

(S.P.R.R. TO BASELINE) — COST $10 MILLION

APPROXIMATE TOTAL PROJECT COST $40,000,000

DAY CREEK WATER CONSERVATION AND FLOOD CONTROL PROJECT

- PROPOSED FACILITIES
- PROPOSED WATER CONSERVATION FACILITIES
- EXISTING FACILITIES
- NATURAL DRAINAGE COURSE

DATE	DRAWN BY	ACAD FILE	S.B.C.F.C.D. PLANNING FILE NO.
OCTOBER 27, 1987	D.F.	PDAYBLM	PM-01-91/blm

Figure 32
DAY CREEK WATER PROJECT
BUREAU OF RECLAMATION

PROJECT DESCRIPTION

The proposed Day Creek Water Project is a Bureau of Reclamation "Small Project" under PL 84-984. The project provides for construction of the following water conservation and related facilities in the Day Creek system, which are located in the west valley portion of San Bernardino County:

a. Debris Dam and Spreading Grounds works in the upper watershed area.

b. Modification of Day Basin to provide for water conservation and peak storm reduction uses.

c. Storm water conveyance system, including approximately ten miles of concrete lined canals.

d. Expansion and modification of two large water conservation basins (Wineville and Riverside Basins).

The Bureau project will provide for a $13.5 million relatively interest free loan to construct a portion of the improvements. The total project is expected to cost approximately $40 million, with the cities of Rancho Cucamonga and Ontario and County of San Bernardino providing the remaining local interest portion through Mello-Roos Assessment and Redevelopment Agency funding sources.

When completed, the water conservation facilities will conserve a minimum of 5,000 acre feet of storm run-off per year into the Chino Groundwater Basin to benefit Agricultural, Municipal and Industrial Water users in the Valley. As is known, the Basin safe yield is in an over-draft condition, which is replenished by importing water from northern California. This project would help reduce the need for purchasing imported water.

PROJECT STATUS

The Bureau Loan Application Report has been approved by the Secretary of the Interior. All environmental issues have been addressed and related permits received.

The repayment agreement has been executed and we are now awaiting initial funding. The project was in the budget for $1 million of initial funding this fiscal year (1987), but was dropped because it was a new start, which were all cut from the budget. The project has also been cut from the 1988 budget year, along with all new starts, even though the Day Creek Water Project was one of the top two new starts favored by the Bureau.

Bureau staff advises it may be several years before any new starts are funded, even though the $600 million appropriation is now available with the recent passage of HR 3113.

Construction of Phase 1 at a cost of $10 million is now proceeding with funds from the local interests. The federal loan dollars are needed as quickly as possible in order to complete the total project within three years.

REQUEST FOR ASSISTANCE

REQUEST ASSISTANCE IN OBTAINING FUNDING FOR THIS PROJECT.

Day Creek Water Project will consist of water conservation basins, spreading grounds, flood control channels, and debris retention dam. The project's drainage area encompasses the cities of Rancho Cucamonga and Ontario. The ultimate yield of the project is estimated at approximately 10,000 AFY. The San Sevaine Creek Water Project will consist of numberous basins, spreading grounds, turnouts, and two dams. The drainage area is approximately 14 square miles within the cities of Fontana, Rancho Cucamonga, and Ontario, in addition to San Bernardino and Riverside County areas. The project will yield approximately 25,000 AFY of conservable runoff from the Etiwanda and San Sevaine Creek tributaries in the form of groundwater percolation to aid in recharging the Chino groundwater basin.

iii. Colorado River Floodway Protection

The Colorado River Floodway Protection Act (1986) is a piece of Federal legislation approved by Congress. The purposes of the Act are twofold as follows:

- To "establish the Colorado River Floodway... to provide benefits to river users..."
- To "establish a Task Force to advise the Secretary of the Interior and the Congress on establishment of the Floodway and on managing existing and future development within the Floodway..."

The Task Force has been subdivided into working committees, and San Bernardino County has representatives on these committees, which were established in mid-1987.

GLOSSARY

AFY - acre-feet per year.

cfs - (Cubic foot per second) - the rate of discharge representing a volume of 1 cubic foot passing a given point during 1 second, and is equivalent to 7.48 gallons per second, 448.8 gallons per minute, or 0.02832 cubic metres per second.

dam - a barrier to confine or raise water for storage or division or to create a hydraulic hear.

dam inundation - the release of flood waters to downstream areas caused by failure of dam.

debris - any material, including floating trash, and suspended sediment, moved by a flowing stream (especially salt, sand, gravel and boulders.

FEMA - (Federal Emergency Management Agency) - A g e n c y responsible for administering the National Flood Insurance Program (NFIP).

flash flood - the occurrence of a dangerous use in water level of a stream or over a land area in a few hours or less caused by heavy rain, earthquake or dam failure.

flood - rising and overflowing of a body of water onto normally dry land.

flood hazard - A substantial possibility of damage to lives or property by overflow water, ponded water, or other water on the surface of the land, or by debris or salt accrued in such water.

flood plain - the relatively flat area or lowlands adjoining the channel of a stream or watercourse and subject to overflow by floodwaters.

floodway - the channel of a stream and that part of the flood plain inundated by a flood and, therefore, used to carry flood flow.

Infrastructure - The basic utilities and services necessary to support development, e.g., sewer, water, drainage, and roads, etc.

NFIP - (National Flood Insurance Program) - a program for subsidizing flood insurance that is not privately available for properties subject to flood hazard.

peakflow - the maximum amplitude of flood waters.

percolation - movement of water through the interstices of a substance, as through soils of a spreading basin.

probable maximum flood - The flood discharge that may be expected from the most severe combination of critical meteorological and hydrological conditions that are possible in the region.

reservoir - A pond, lake or basin, either natural or artificial, for the storage, regulation and control of water.

riparian - Pertaining to the banks of a body of water.

SBCFCD - San Bernardino County Flood Control District.

seiche - An earthquake - generated wave within enclosed or restricted bodies of water (e.g. lakes and reservoirs).

snowmelt - a season's accumulation of snow.

snowpack - a season's accumulation of snow.

spillway - A passage or open channel over or through a dam or embankment for carrying water and suspended materials downstream.
Standard Project Flood - a major flood that can be expected to occur from the most severe combination of meteorologic and hydrologic conditions that is considered reasonably characteristic of the geographical area in which the study area is located excluding extremely rare combinations.

subsidence - generally level, vertically downward earth movement caused by reduction in solid water pressure.

thunderstorm - a local atmospheric disturbance of short duration accompanied by electrical phenomena and heavy showery precipitation, and often by wind gusts and sometimes by hail.

VVIEP - Victorville Valley Infrastructure Enhancement Program.

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FIRE

FIRE

INTRODUCTION

Fire is a natural part of everyday life. It is used to heat and cook. Many homes include a fireplace as the focus of family living areas. Camp fires and barbeques are national pastimes. In addition, fire has always occurred as a natural phenomenon. It has been a dynamic natural force that revitalized vegetation. As a result, fire risk is often downplayed. But when fire comes into conflict with human development, the results can be disastrous.

1987 was the worst fire year in sixty years, especially in California, Oregon and Idaho. More than 53,000 fires devastated more than 837,000 acres with fire suppression costs exceeding $261 million. Light snowpack in the western mountains can mean a heavy summer fire season. Adequate preparation for fire occurrence and realistic perceptions of the nature of fire, its hazards and risks are crucial to public protection from fire disaster.

SECTION I. DEFINITIONS

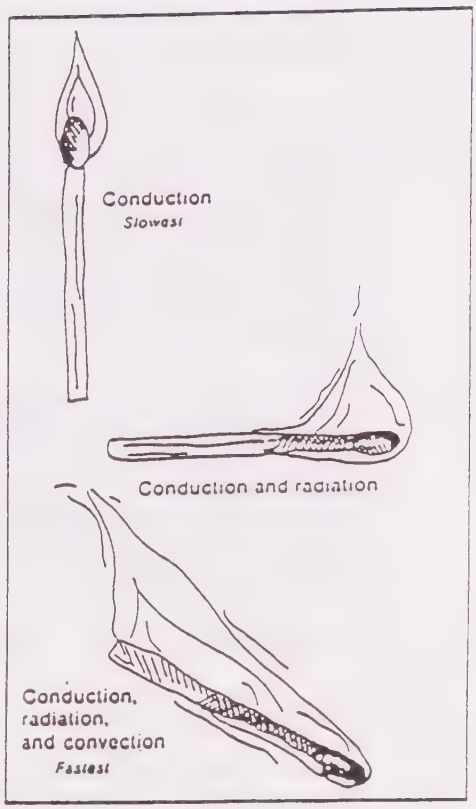
Fire Protection

Fire protection is of critical importance, Fire protection consists of the man-made facilities and equipment to extinguish fires, along with the programs policies, standards, regulations, etc., to prevent fires from happening.

Fire

Fire is the occurrence of combustion (burning or oxidation) resulting in heat, flame and light. Understanding the behavior of fire is helpful in evaluating surroundings for hazard. Once an object reaches its ignition temperature (the degree of heat required to cause combustion) ignition occurs. Ignition temperature is reliant upon oxygen supply, speed of heating, and the size, shape, and composition of the object. Flame is the visible portion of burning gas, produced by combustion, resulting in light. Flame length can exceed 100 feet and is controlled by the height and density of the fuel source, windspeed, degree of slope, fuel moisture, fire spread and other characteristics of the fuel itself. A fire is considered to be out of control when it exceeds 35′ in height.

FIGURE 1



Heat transfer occurs in three ways: conduction, convection, and radiation. Conduction is the straight transmission of heat by objects touching one another. Convection is the transmission of heat through the motion of air. It is most prevalent during windy conditions and on steep terrain. Radiation is the transmission of heat through electromagnetic waves. It can travel against the wind. An example of radiation would be the preheating of a slope opposite a fire to ignition point. Figure 1 illustrates the interaction of all three types of heat. When the match is upright only conduction occurs and the burn is slow, (as in a fire burning downhill). When the match is horizontal, conduction and radiation transfer heat, speeding the burning process somewhat. In the third instance, the match is held down simulating a slope situation. All three processes occur and the fire burns much faster.

Fire Hazard and Risk

Fire hazards and fire risks must both be considered in understanding and dealing with the overall fire issue. Fire hazards are those components of the burning (combustion) function that burn or exacerbate burning. Topography, climate and fuels (vegetation and structures) form the fire hazard. They are, with the exception of structures, natural. Fire risk is brought into play when fire hazards come into conflict with human use and occupancy. Sources of risk are direct exposure to flame, radiated heat, or firebrands carried by wind, convection columns or both. These are almost entirely man-caused. Only 4.2% of all conflagrations are caused by lightning, the primary natural cause of fire.

There are two distinct components of the fire issue: wildland fire and urban fire. Although wildland fire can be naturally caused (ie. lightning) it is more often caused by man and his machines. It is a natural hazard with both natural and man-made risk. Urban fire is almost exclusively a man-made hazard and risk. The urban-wildland interface forms a third, less distinct component, where the wildland and urban components merge.

Wildland Fire

Wildland fire is also known as brush or forest fire. Although occurring in more remote areas, a wildland fire is capable of burning thousands of acres and threatening the lives and properties of hundreds. Wildland fire poses the most chronic and probable threat for a large disastrous fire. In 1985, California's more than 60 wildfires caused five deaths, ravaged 700,000 acres, destroyed 250 homes and numerous other structures, causing over $100 million in property damage and over $50 million in fire fighting costs.

Urban Wildland Interface

The Urban wildland interface is the area where the wildlands meet urban development. There are three types of interface: mixed interface, occluded interface, and classic interface.

Mixed interface occurs when isolated homes are surrounded by large tracts of land. Figure 2 shows an example. Occluded interface is characterized by large wildland areas (usually within an urban park setting) surrounded by an urban area. The Griffith Park area in Los Angeles is an example of an occluded interface. Classic interface occurs when new construction presses against wildland vegetation across a broad front. Figure 3 illustrates classic interface. By 1990, 10 million Californians will reside in interface areas.

FIGURE 2 Mixed Interface

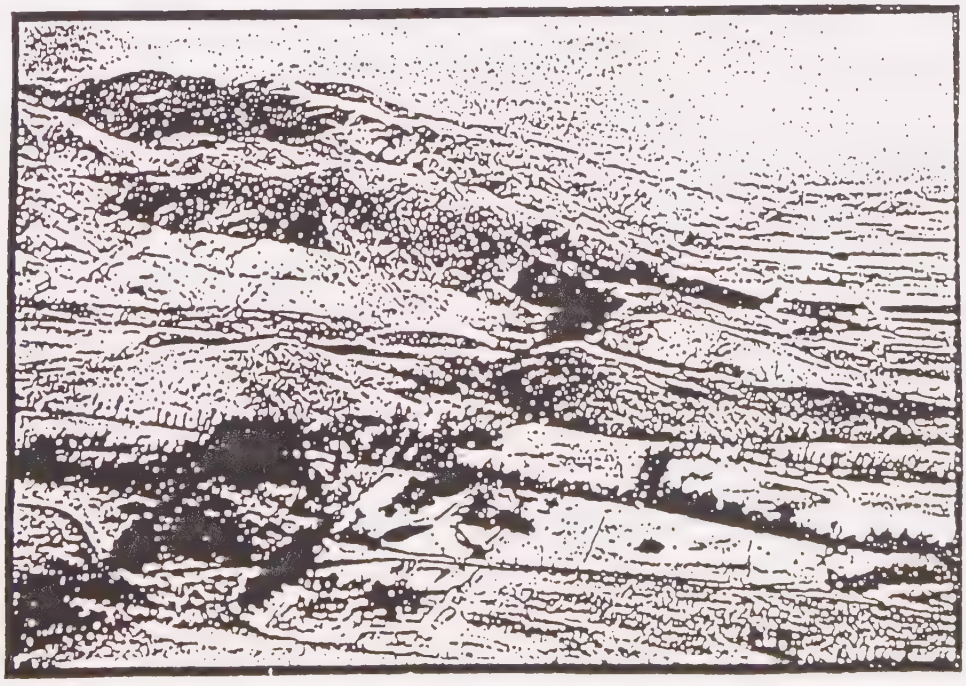
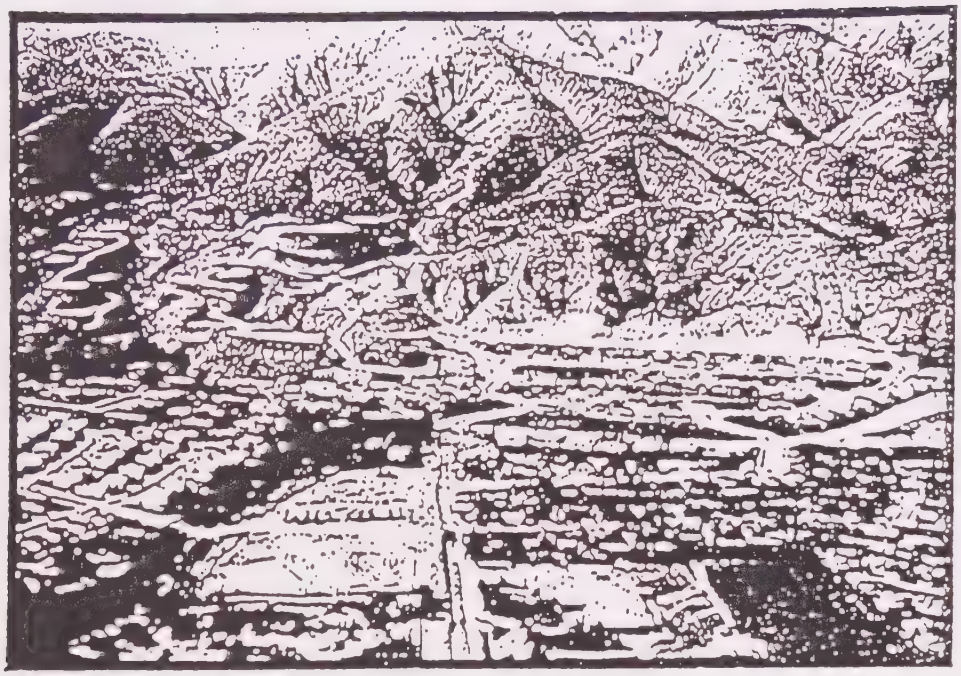


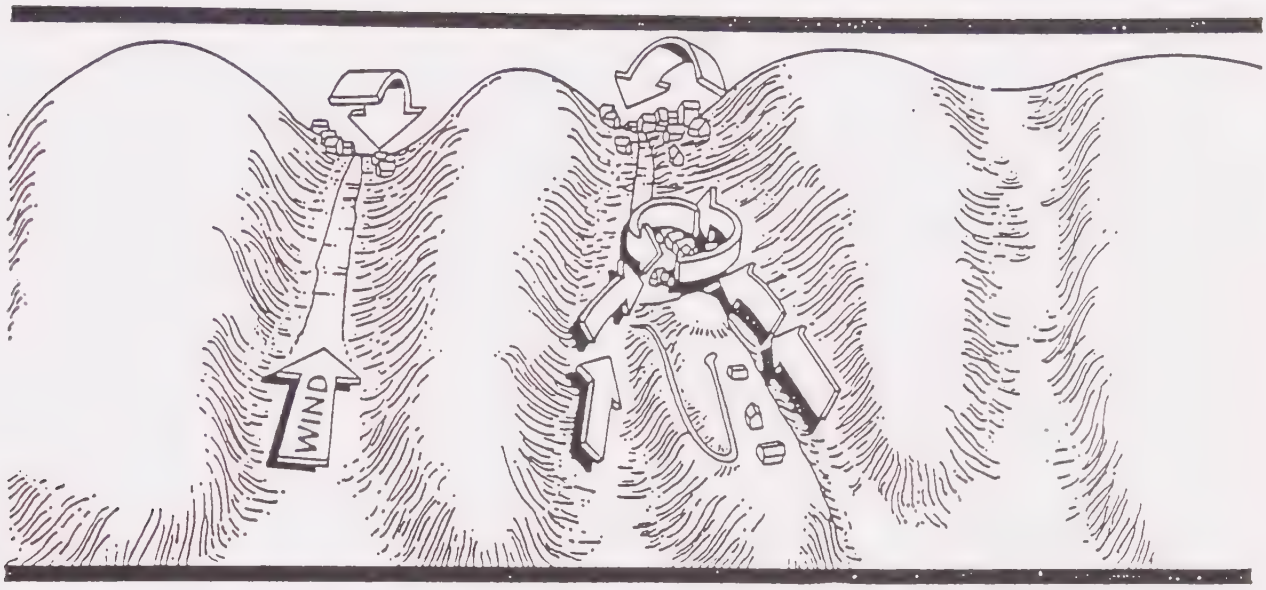
FIGURE 3 Classic Interface



There are several major contributing factors to wildland and interface fire. They are topography, climate, vegetation and human use and occupancy.

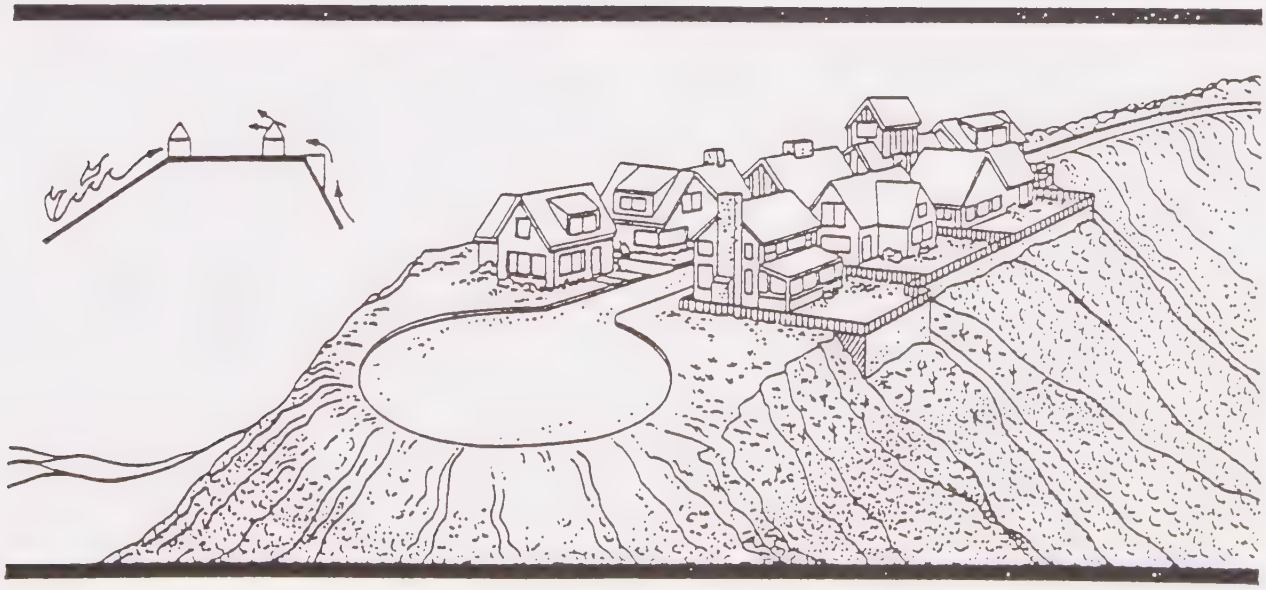
Topography is a major concern in determining fire hazard. The rugged terrain found in foothill and mountain areas has a two-fold effect. The first involves the character of the fire itself. Canyons, ridges and saddles join to reflect and deflect both flames and the heat of a fire and any winds that may be present. Fires can run uphill 16 times faster than downhill. The fuel sources of the higher elevations are preheated and convection columns are created even in the absence of wind. So slope is of vital concern. Canyons become chimneys and function much as any fireplace or barbecue chimney would by trapping the heat and intensifying combustion. Figures 4 and 5 provide a graphic depiction of these problems.

FIGURE 4



Narrow Canyons and ridge saddles are natural fire chimneys.

FIGURE 5



Homes placed directly against slopes are particularly susceptible to flames and undermining erosion.

The second effect topography has on fire involves the ability of firefighters to adequately access hazard areas. Road, fire break and water supply construction are difficult and therefore expensive in areas of severe slope and rugged terrain. The result is a reluctance to construct adequate facilities. For example, the maximum slope considered feasible for heavy fire equipment access is 12 to 14%. In mountain, foothill and interface areas where there are slopes over 40%, substantial grading would be required to construct that road, and at a width able to accommodate not only the fire equipment itself, but also any residents trying to escape a fire.

Climate also plays a major role in determining fire risk. Precipitation, temperature, and wind are climatic conditions that affect fire hazard the most drastically. Lack of rain, high temperatures, and strong winds can result in a tinderbox situation that can be impossible to control if ignited.

Wind is the most critical factor of the three conditions. It provides added oxygen needed for combustion. It robs the air and fuel of its moisture content. It bends the flames, preheating adjacent fuel sources. And, most critically, it carries burning firebrands far ahead of the fire front.
Lack of rain, especially in a drought situation, results in the drying of vegetation making it more susceptible to ignition. It also results in the addition of more dead foliage increasing fuel loading.

High temperatures have much the same result. They reduce moisture in the fuels and also raise the temperature of the fuels closer to ignition point.

Obviously, the more of these climatic conditions that are brought into play, the more hazardous the fire situation becomes and the more difficult a fire, once started, is to control.

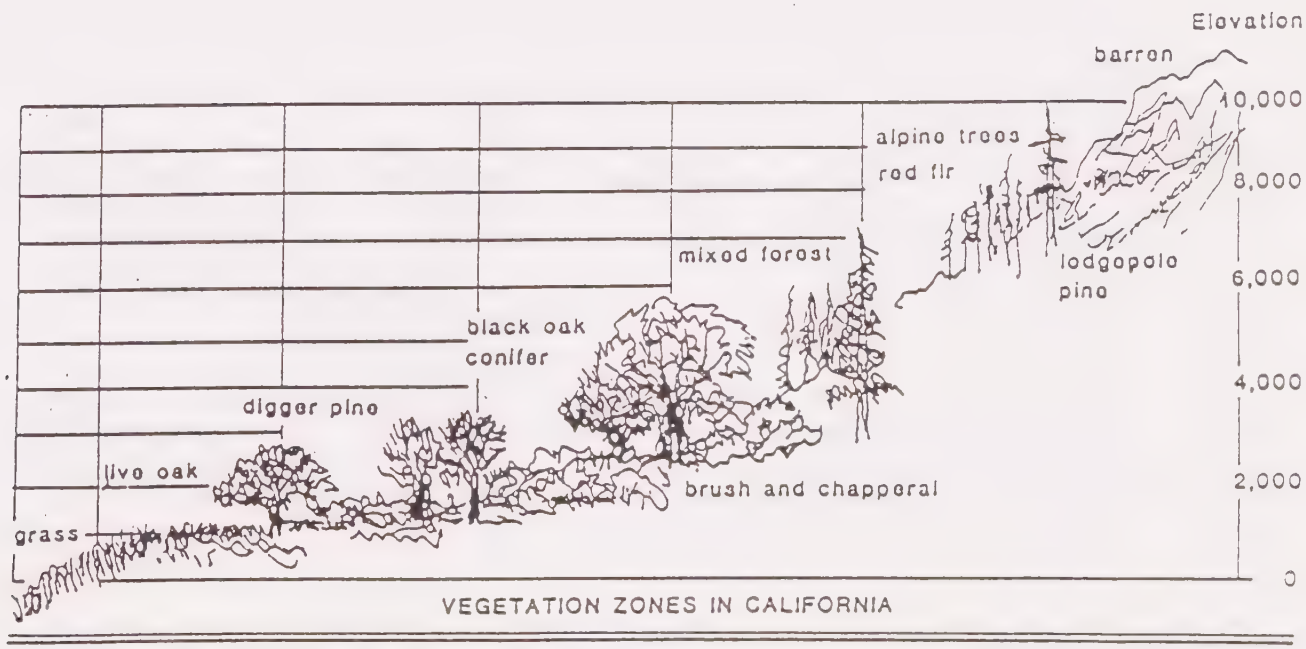
California has a Mediterranean climate. It is characterized by hot, dry summers and wet, moderate winters. Extremely hazardous fire conditions often occur from June to December, or until the winter rains start. Annual rainfall ranges from under 10 inches in Southern California to about 32" in the north. In addition, strong Santa Ana winds blow from north or northeast out of the Great Basin of the Utah-Colorado area. The effect produces hot dry air with gusty winds. When these winds meet local mountain winds, erratic conditions occur, increasing the difficulties involved in predicting fire front behavior or spotting ahead of any fire.

All vegetation forms are fuel for fire. Vegetation zones for California are shown in Figure 6. Some types of vegetation are more flammable than others. Irrigated landscaping materials are generally much less flammable than plants that occur in the

natural state found in wildland areas. In wildland areas vegetation is the primary fuel source for fire.

Chaparral, a fragile plant ecosystem found in California and many other regions with similar, Mediterranean type climate, is especially susceptible to wildland fire. This vegetation is subject to dry periods with no supplemental irrigation to decrease its flammability. Dead materials are not cleared away in the wild. They accumulate combining with live foliage to form a buildup of available fuel, called fuel loading, that can amount to over 50 tons per acre. When these fuels ignite they burn very rapidly covering hundreds or thousands of acres if not immediately controlled. When control is not achieved, the amount of energy and heat released by such a conflagration nears that of an atomic bomb with flame heights reaching over 100 feet, leaping roads and other obstacles and throwing firebrands that may come to rest many miles downwind. In fact, chaparral has adapted and thrived on the cycles of summer drought and frequent fire over millions of years. Due both to its drought tolerance and its high oil content it burns with extreme fire intensity. It has not, however, had to adapt to the effects of human occupancy until more recently. And when chaparral combines with structures in the urban wildland interface, available fuel is further amplified.

FIGURE 6



VEGETATION ZONES IN CALIFORNIA

Human use and occupancy form the final, most critical factor in major wildland or interface fires. The American Dream has always been involved with ownership of one's own living space. It started hundreds of years ago with the early settlers moving ever westward in search of more space, more private land. It shifted briefly in the 1920's when the majority of Americans lived in urban settings. By the 1970's, that migration had reversed and America was once again heading for the wide open spaces. However, there was a change. Those who were moving into these more rural areas were used to the full range of urban services, including urban type fire protection. Things that were taken for granted in urban areas cannot be assumed in the interface: a nearby well-trained, fully staffed fire department, a fire hydrant on every corner, a non-flammable exterior environment, a street wide enough to accommodate almost any size emergency vehicle, and a road system that permits access from many directions. Whether vacation homes or permanent residences, new developments have been juxtaposing themselves between the wildlands and more urban development. They are drawn by many of the very things that exacerbate the fire hazard: slopes which provide the homeowner with a lovely view, natural foliage increasing privacy and a rural feeling, winds that clear the air blowing the smog away, and narrow accesses also increasing the feelings of privacy and country atmosphere. Figure 3 on page 40 illustrates the intrusion. The urban wildland interface was created. Along with it the multiplicity of problems caused by any such hybrid were also created. Urban development requires urban services, in this case, fire protection. However, those fire protection services designed to deal with fire hazard in the urban setting were not equipped to fight that hazard in the wildland setting. At the same time, those fire protection services designed to fight fire in a wildland setting were severely hampered in the presence of urban development.

To make matters even more complicated, the mere presence of human occupancy increases the risk of a major wildland fire drastically. According to the Task Force on California's Wildland Fire Problem, over 90% of the fires involving vegetation are caused either by people or by their developments (e.g. arson, machinery, or power lines).

Combinations of two or more adverse conditions in the areas of topography, vegetation, climate or human use and occupancy increase both hazard and risk. Figures 7 and 8 show combinations resulting in a fire hazard rating. Figure 9 shows how wind and fuel height combine to affect flame height.

FIGURE 7

FIRE HAZARD SEVERITY SCALE

CRITICAL FIRE WEATHER FREQUENCY	I		II		III	
FUEL LOADING	SLOPE % 0-40	41 +	SLOPE % 0-40	41 +	SLOPE % 0-40	41 +
LIGHT (GRASS)						
MEDIUM (SCRUB)						
HEAVY (WOODS-BRUSHWOODS)						

MODERATE | HIGH HAZARD | EXTREME HAZARD

FIGURE 8 Fire Hazard Increase With Slope

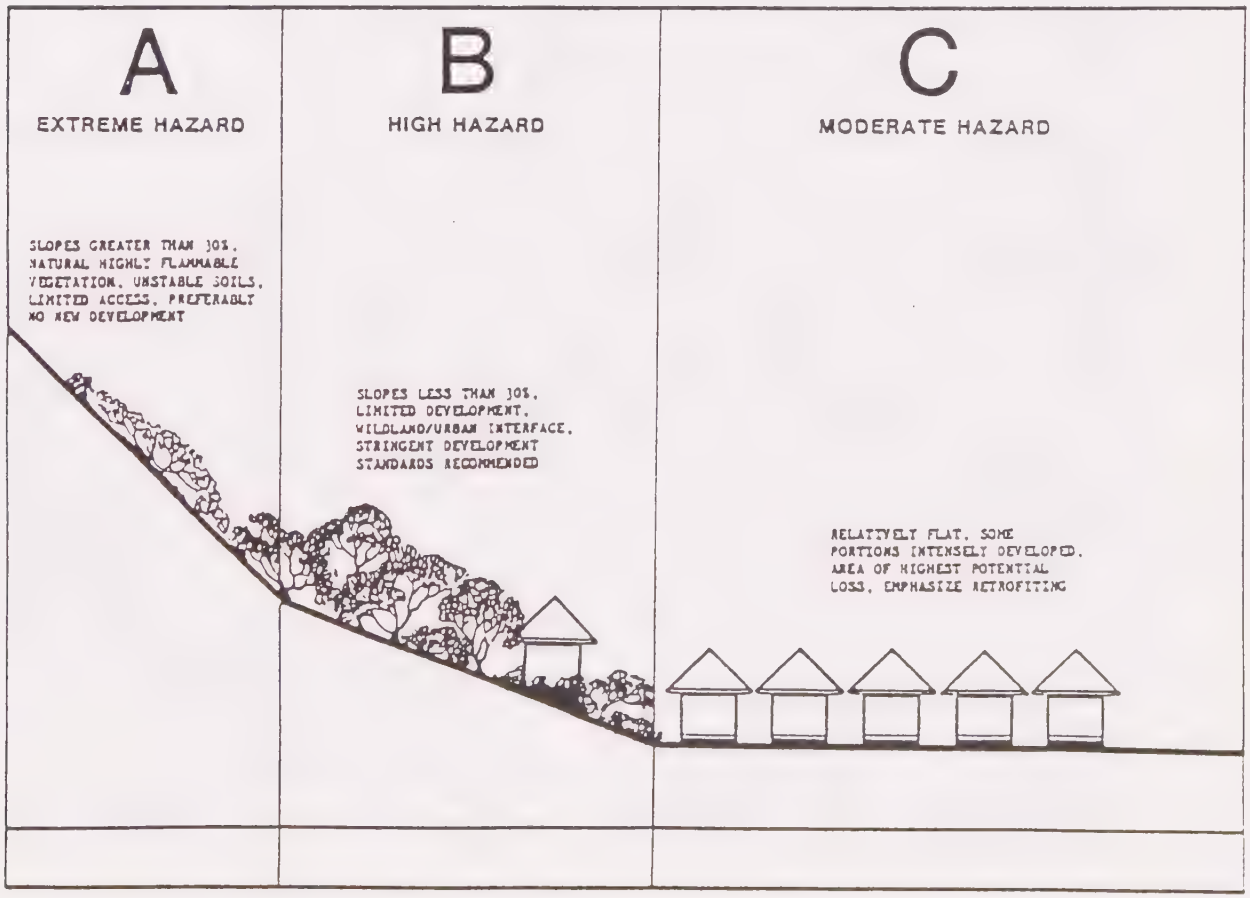


FIGURE 9

Effect of windspeed and fuel height on flame length*

Windspeed at midflame height (mph)	2-ft low-fuel plants Flame length	6-ft chaparral (ft)
5	9.1	27.7
10	12.9	39.5
15	16.2	49.9
20	19.3	59.5
25	22.1	68.3
30	24.7	76.6
35	27.2	84.4
40	29.6	91.9
45	31.9	99.1
50	34.1	106.0

Although the actual ignition and burning of a structure and the threat to human life from fire itself is of primary concern, there are also secondary hazards involved with wildland fire that form almost as much of a threat to man and his environment. Any large fire has the capacity to produce both erosion and flooding problems at the next rain, especially where slopes or canyons are involved.

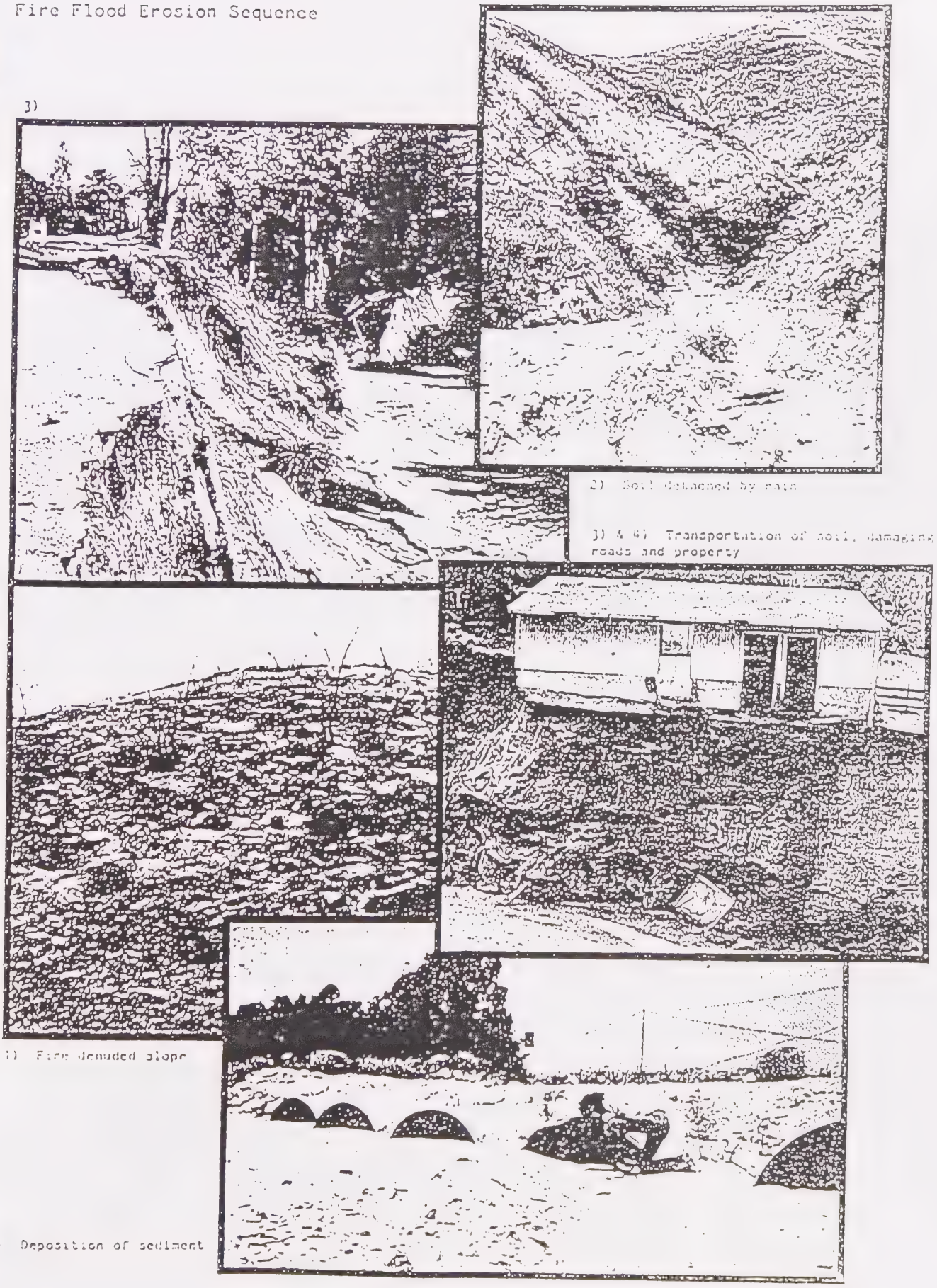
The denuded look a hillside displays after a major fire is an indication of severe hazard to downhill development. The raw soil can no longer absorb the moisture produced by rains, especially if they are heavy or prolonged. In addition, some soil types are actually made hydrophobic (water-repellant) by fire. Run-off is, therefore, accelerated, by up to 40%. The result can be flood waters and also increased capacity of the run-off to carry debris, from soil and mud to gravel and even boulders. The effects of flood will be examined in a subsequent background report. However, it is important to remember that many of the natural and man-made hazards discussed in the General Plan are not isolated. They affect other hazards and in turn are affected by them. Figure 10 illustrates the fire-flood-erosion sequence.

Another effect of the fire-flood-erosion sequence is that, because the earth does not retain the water in these areas, water does not percolate into the soil. It no longer reaches the water table. Valuable watershed is lost, 95% of California's precious water supply comes from and is stored in our wildland areas.

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* From Radtke, Living More Safely in the Chapparal-Urban Influence.

Fire Flood Erosion Sequence



Keeping these forest, brush and grass-covered lands safe from wildfires is critical to maintenance of the quantity and quality of our water supply. So is the natural habitat of the area's denizens.

There are ways to minimize the threat of fire in the wildland interface area without prohibiting development altogether. Obviously, the areas in which to consider modification of development standards would include topography, climate, vegetation, and human use and occupancy. Grading modifies topography. There are, however, limits to the areas that can be controlled. Climate is difficult at best to modify. Wind cannot be stopped. While clouds can be seeded to provide extra rain, that is an extreme measure. By maintaining an adequate water supply, at least moisture level can be affected. Vegetation can be modified through a variety of means. Human use and occupancy can be restricted, through that is not always feasible. Policing for fire prevention in the vast wildlands is much more difficult than in the cities. According to Wildfire Strikes Home, the Report of the National Wildland/Urban Fire Protection Conference, "Starting a fire in the wildlands is within anyone's reach without excessive risk and without sophisticated tools. Continuous surveillance is impossible." Existing and proposed policies and practices will be examined later in this report with a view to evaluating their adequacy in reducing fire risk to an acceptable level.

Urban Fire

Urban fire is approached in a very different way from wildland fire. Urban fires are primarily structural and involve higher concentrations of population. The potential for large loss of life is, therefore, greater. Fire protection levels are usually higher, reflecting the population's lowering of their level of acceptable risk. The first paid municipal fire department in the world was established in Boston in 1679, and United States' fire departments have been an integral part of the American urban scene ever since. Despite this the United States and Canada still have a higher death rate due to fire than Japan or any country in Western Europe. The cause is summarized in America Burning, the Report of the National Committee on Fire Prevention and Control NCFPC (1973):

> Indifferent to fire as a national problem, Americans are similarly careless about fire as a personal threat. It takes the careless or unwise action of a human being, in most cases, to begin a destructive fire. In their home environments, Americans live their daily lives amid flammable materials, close to potential sources of ignition. Though Americans are aroused to issues of safety in consumer products, firesafety is not one of their prime concerns. And often when fire strikes, ignorance of what to do leads

them to panic behavior and aggravation of the hazards, rather than to successful escape.

Structural fires result in 85% of all deaths due to fire. Leading causes of structural fires can be classified in one of two categories: internal or external ignition. Heating and cooking equipment are primary sources of internal ignition, particularly in the home environment. Smoking materials or incendiary and suspicious ignitions can be either internal or external.

In the home environment, fire is the second leading cause of accidental deaths, after falls. Fire in the home is responsible for approximately 80% of all fire deaths, 67% of all fire injuries, 70% of all structural fires and 61% of all structure fire property loss reported to municipal fire departments in the United States. Smoking materials and heating/cooking equipment are the first and second leading causes of those structural fires in the U.S. home environment.

The industrial environment is second only to the home in property loss due to fire. However, the leading cause of fire loss in storage properties, industrial, or manufacturing uses is arson. Ignition by arcing electrical systems, failure or misuse of heating systems, and careless use of welding torches are also major contributors.

While the risk from urban fire is different from that of wildland fire it is also possible to minimize that risk. In fact, the number of civilian fire deaths in the home showed an overall decrease of 32.2% from 1978-1984. According to Arthur Cote, Assistant Vice President/Standards of the National Fire Protection Association, "This impressive decrease is probably due in part to recent home firesafety efforts, including the passage of numerous state laws and local ordinances requiring the installation of smoke detectors in residential properties."

Other measures used to mitigate the risk of urban fire would have to involve both external and internal ignition preventatives. One of the primary fire threats in urban areas involves the concentration of the population into smaller areas. While fire services are also concentrated, more people are still exposed to risk in a smaller area. Therefore, methods to provide for swift containment would be of supreme importance. Building density, building spacing, construction standards roofing types, etc. are pertinent considerations. In addition, requirements for adequate installation of heating and cooking equipment and education concerning their proper use would also be relevant. As with wildland fires, policies and practices will be evaluated in light of these considerations later in this report.

SECTION II. CURRENT STATUS

While it will be shown that San Bernardino County has substantial fire hazards, comprehensive steps have been taken to reduce the risks associated with those hazards.

Data Sources/Mapping

Several sources of information have been obtained to identify the full extent of the fire hazard and the agencies responsible for fire protection in San Bernardino County. As previously noted, some conditions are especially important for identifying that hazard in wildland fire areas. They include topography (slope), climate, vegetation, and human use and occupancy. As a part of the General Plan Update, an ambitious program of digitized mapping was accomplished. This mapping will aid in location of hazards, speed quantification of areas subject to them and help guide development throughout the County.

Mapping indicating areas especially susceptible to fire are included in the Mountain Fire Zone and the Greenbelt areas. They composite many of the above conditions (fuel loading, slope, rainfall, etc.) resulting in a delineation of hazard and risks. Maps identifying areas of human use and occupancy will also be provided in later portions of this text. While the mapping of wind hazards is in progress, wind information appears on subsequent pages of this document.

Scope of Existing Conditions and Trends

Wildland Fire and Urban Wildland Interface.

The combination of several physical factors along the foothills of San Bernardino Valley exposes development and natural resources to potential disaster from wildland fires and subsequent flooding and erosion. This potential was tragically exemplified by the 1980 Panorama Fire. The physical factors include topography, climate, vegetation and human use and occupancy. The primary fire hazard areas in San Bernardino County are the Chino Hills, San Gabriel and San Bernardino Mountains and their surrounding foothills, the Redlands-Badlands area, and Crafton Hills. These areas are susceptible to wildland fires due to: (1) the ruggedness of the terrain, (2) the types and amounts of vegetation, (3) climatic factors and (4) the presence of people and development. The four categories stated above combine to make the San Bernardino County wildlands an extreme fire hazard area. Any one factor or combination thereof is enough to constitute a classification of high or extreme hazard.

The terrain in the Mountain and foothill areas is characterized by slopes increasing to over 40%, steep-walled, deeply incised canyons and valleys, and sharp, narrow ridges. The Mediterranean

climate of the south western portions of the County becomes hotter, more arid, more desert-like, the farther east and north one travels. Hot Santa Ana winds often parch already dry vegetation and residents. Chapparal forms the largest single vegetation type in the area, predominating in the interface areas.

The intrusion of land use and occpuancy into high hazard areas is found in the foothills in the classic interface mode. Mixed interface is found in North Yucaipa, North Devore and other more rural areas. It is important to remember that interface also occurs in the mountain setting where urban densities are increasingly found in and around recreation areas. Mountain homes are the primary residence of many San Bernardino County residents, some who commute to the Valley to work. Occluded interface is not prevalent in the County at this time although, as our regional parks grow and are gradually surrounded by development, that may change. According to CDF, no wildland areas are classified as low fire hazard zones in California. In fact, California is the most hazardous fire region in the world, similar only to the southern coast of Australia in terms of fire danger, according to Jerry Portain, director of CDF. In reviewing the Fire Hazard Severity Scale (Figure 7) San Bernardino County falls in Class III, where critical fire weather occurs more than 9.5 days per year, the most severe rating.

An examination of the circumstances involved in the infamous 1980 Panorama Fire shows how devastating fires can and do happen in San Bernardino County. Fire conditions in late November, 1980, were prime for such a disaster. It had been six months since the last rain, temperatures were much higher than normal and the wind exceeded 75 mph with gusts up to 100 mph. At the height of the conflagration the fire was totally consuming structures within 12 minutes of roof ignition. Over 180 homes were lost in one hour. A total of 325 structures were destroyed, 55 damaged. There were four deaths, 77 serious injuries, and 23,600 acres consumed. Property damage was estimated at $40 million. Fire suppression costs exceeded $6 million as 2610 firefighters fought for one week to extinguish the fire. Losses to natural resources exceeded $12 million. Figure 11 shows the aftermath of the fire.

During the Panorama Fire, a series of 11 fires was taking place in Southern California. It extended from the 24th of November through December 1st. At the peak of the siege, 8,600 people were involved in the fire suppression effort, (constituting the World's largest fire department) with three more of those fires also located within San Bernardino County. A total of 90,000 acres was consumed, 370 structures destroyed, and four people killed. Suppression cost was estimated at $15,000,000 with estimated structural property damages reaching $47,261,165 and resource damage at $32,816,620.

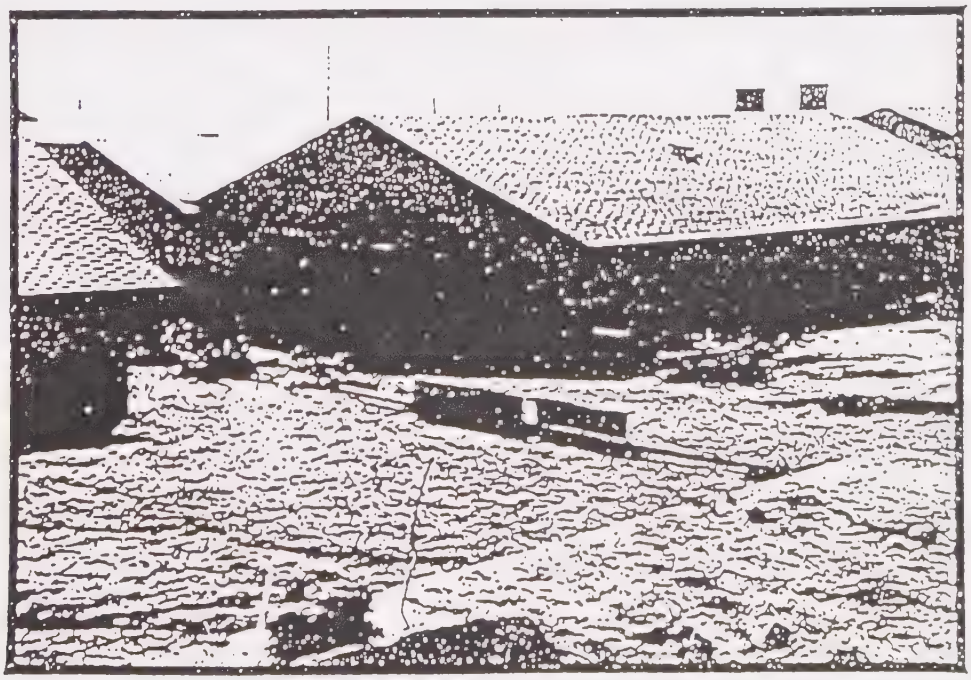


Destruction of the 1930 Panorama Fire along Dover Dr. and Northpark Blvd. between H and F Streets.

The Panorama was not the first urban-wildland fire in the valley, but never before had losses been so great in the San Bernardino area. The primary reason for these losses was the continued intrusion of development into the foothills without appropriate vegetation management and design techniques.

Secondary effects of urban wildland fire are also seen in San Bernardino County. As discussed earlier, post-fire winter storms hat occur before the reestablishment of vegetation, drop considerable rainfall on denuded slopes. Unprepared downhill communities can suffer drastically from flooding and mudflow as a result of erosion related to wildland fires and inadequate drainage control. The post-fire mudslides in Harrison Canyon in 1979 are a prime example. Sediment and other debris from the barren hillsides above Harrison Canyon created a mudflow which did considerable damage to 24 houses along Hampshire Avenue. See Figure 12. The City of San Bernardino, the State and federal governments spent over $1.5 million to purchase and remove the homes. The street is now being developed as a linear park.

FIGURE 12



In addition, approximately 90% of the County's water supply comes from watershed areas. Water supply and quality is of vital concern to the County. (See on Water Supply and Water Quality sections.)

Fire Protection Services

Fire protection services and the agencies providing those services in San Bernardino form a complex picture. The County of San Bernardino has contracted with the California Department of Forestry and Fire Protection (CDF) for 67 years to provide fire protection in unincorporated areas of the County. Nearly 50 other fire departments and fire protection districts serve other unincorporated County areas and cities; some of the fire protection agencies are County Board of Supervisors-governed while others are self-governed. The County of San Bernardino has contracted with the California Department of Forestry for 67 years to provide fire protection in the unincorporated areas of the County not served by nearly 50 other fire departments and fire protection district. In the National Forest, the United States Forest Service shares fire protection and prevention responsibilities.

Within the areas covered by CDF 37% of all fire incidents in 1986 were vegetation fires. In 1986 over 3772 acres burned, a 132% increase over 1985. And 56% of all wildland fires were caused by arson.

Although CDF is responsible for a majority of wildland areas, their area also includes urban areas.

Urban Fire

In 1983 approximately 78% of the population of San Bernardino County resided in the Urban Valley area of the southwestern portion. 24% of the Valley population was located within unincorporated areas and is served by CDF/County Fire Warden. A complete breakdown of all CDF 1986 fire activity is found in figures 13 through 16.

FIGURE 13

1986 Fires by Type

		% of total
Structure Fires	693	23%
Vehicle Fires	788	26%
Refuse Fires	353	12%
Improvement Fires	51	2%
Vegetation Fires	1093	37%
	2978	100%

FIGURE 14

Fire Causes

	1984	1985	% change 84-85	1986	% total	% change 85-86
Equipment Use	614	659	7%	580	36%	-12%
Miscellaneous	285	308	8%	277	17%	-10%
Playing with Fire	247	249	1%	233	15%	-6%
Arson	120	135	13%	201	13%	+49%
Debris burning	116	150	29%	152	9%	+1%
Campfire	42	92	25%	71	4%	-23%
Smoking	81	61	119%	66	4%	+8%
Lightning	76	14	82%	25	2%	+79%
	1581	1668		1605	100%	

FIGURE 15

Fire Loss Comparisons

	1984	1985	1986
Fires	1,581	2,258	29261 (+31%)
Acres burned	2,332	1,627	3772 (+132%)
Damages - $	$5,077,000	$7,869,960	$8,655,400 (+32%)

FIGURE 16

Arson Statistics

Fire Type	1984	1985	1986	%
Structure	29	35	34	17%
Wildland	47	42	112	56%
Vehicle	35	42	43	21%
Miscellaneous	9	16	12	6%

Within the urban setting, fire hazard is greatest in the interface areas, however, fire risk is also a factor away from the urban wildland interface. Structural and improvement fires amounted to 25% of all CDF fires. Condition of those structures is a critical consideration. In 1980, about 3% of all County housing was substandard.

Historical buildings, especially those of wood construction with their lack of modern materials and methods are particularly susceptible to fire. The California Hotel, one of the largest and oldest buildings in Needles, was destroyed by fire in 1986. In the East Highlands area, the Beattie ranch and the Cram house, both recognized historical structures, were victims of fire. In fact, in any area where wood construction and shingle roofs prevail when combined with narrow building separations the possibility increases. There are many such areas in the County. In addition, to shade their homes from the extreme heat that is a characteristic of the climate, County residents have done extensive tree planting. Where these plantings overhang wood roofs, fireplace chimneys, and abutting structures, the possibility of a fire rapidly moving from one structure to the next poses a severe risk.

The mere characteristics of urban living-close neighbors, extensive vegetation, storage of flammable products, and use of heating and cooking facilities promote a fire susceptible environment. However, the urban area also has a higher concentration of fire suppression facilities with response times vastly superior to those in wildland areas.

GLOSSARY

CDF - California Department of Forestry and Fire Protection.

Chaparral - native brush of mixed species (scrub oak, chamise, manzanita, toyon, etc. in California).

Combustion - the act of burning.

Conduction - the transmission of heat from one object to another by direct contact.

Conflagration - a raging, destructive, fast moving fire extending over a large area.

Convection - the transmission of heat through the motion of air.

Critical Fire Weather - such weather occurs only during a few days of each fire season and is broadly characterized by a period of prolonged drought, low moisture content in wildland vegetation, high wind velocity, and/or instability in low level atmosphere.

Fire break - an area, usually a long strip where vegetative fuels are reduced in volume usually to bare soil and maintained so as to produce a reduction of fire intensity.

Greenbelt - an area experiencing specific measures designed to mitigate fire, flood and erosion hazard including fuel management, land use planning, and development standards. More traditionally an irrigated landscaped buffer zone between development and wildlands, usually put to additional uses e.g. golf courses, park, etc.

Mediterranean climate - a relatively mild weather pattern characterized by winter precipitation and long, hot, and dry summers.

Rural - any area wherein the residences and other developments are scattered and intermingled with forest, range or farm land and native vegetation or cultivated crops.

Urban - in this report refers to any area wherein the residences and other works of man form an essentially solid covering of the landscape, including most areas within cities and towns, subdivision commercial and industrial parks, and similar developments whether inside city limits or not.

Urban-wildland interface - the area of transition between urban development and usually rugged open space natural vegetation, Generally centered about an abrupt slope change.

Wildfire - an uncontrolled fire burning in wildland vegetation, structures and other improvements.

Wildland - timber, range, watershed and brush lands not under cultivation and in which development is essentially nonexistent usually rugged open space terrain.

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WIND AND EROSION

WIND AND EROSION

INTRODUCTION

"High winds spark fires, leave two dead in Southland."
"Fontana wind damage assessed at over $6,000."
"County hit by winds of 80-100 mph."
"60 mph winds wreak havoc in S.B. County."
"Gusting winds snarl traffic in two counties."
"High-powered winds pummel Valley again--Santa Anas knock out power; 23 schools close."

Just a few headlines from local newspapers are a reminder that wind can pose a hazard in San Bernardino County. Wind causes damage directly by blowing over powerlines, fences, trees and vehicles and blowing off roofing materials, patio covers and other building components. Wind causes damage indirectly by sending fires raging out of control and whipping up dust storms, obscuring visibility. Blowing trash and trash cans, rattling windows and downed palm fronds are relatively minor annoyances many County residents face regularly. Downed powerlines and trees, broken windows and flying patio covers and roofing materials are more severe consequences of wind that often affect many portions of the County. Large trucks and campers are overturned and reduced visibility due to blowing dust results in vehicular accidents. Disruption of utilities, schools, traffic and aviation operations can result.

SECTION I. DEFINITION

Solar energy is the ultimate cause of wind. The quantity of solar radiation reaching the earth's surface varies from one place to another. This surface, whether water or land, responds differently to the resultant heating. The ability of water to store heat is different than the land's heat retention capacity. The oceans heat up and cool down more slowly than does the land. Because air is largely heated by conduction from the earth's surface, the temperature of the atmosphere over a land or water surface is tremendously influenced by the underlying surface's temperature.

A region of low pressure is created by warm buoyant air rising. Air from surrounding areas of higher pressure is sucked in to replace the rising air. This sucking movement produces wind.

Winds that cause most of the damage in Southern California are known as Santa Anas. Many negative effects have been attributed to these winds. Suicides, increased crime, and illness have been ascribed to the Santa Anas. Renowned Southern California writer, Raymond Chandler described the Santa Anas as "sinister, hot, dry winds that curl your hair and make your nerves jump and your skin itch..."

While the usual season for the Santa Anas' occurrence is in the fall months (September through December) they can occur anytime and usually do so--from five to ten times per year. Although such winds are not a common condition world-wide, similar wind environments do exist in other parts of the world when geography and meteorology are just right: the Foehn winds of Norway and the Chinooks of the U.S. and Canadian Rockies are two such examples.

According to Dan Bowman, a meteorologist from WeatherData, Inc., a Santa Ana condition is precipitated by a high pressure system to the North combined with a low pressure system to the South with winds flowing from high to low pressures. Thus, winds are generated from an interaction of weather systems.

First, a cold air mass is produced out of the North Pacific and Gulf of Alaska. It moves southeast, setting in the Great Basin deserts and plateaus (Northern Nevada, Utah, etc.). Then a high pressure system of dense air several miles above the ground moves over the flatland descending onto the cold air mass below, spreading out and spilling over the mountains. The air dries out and warms up as it descends.

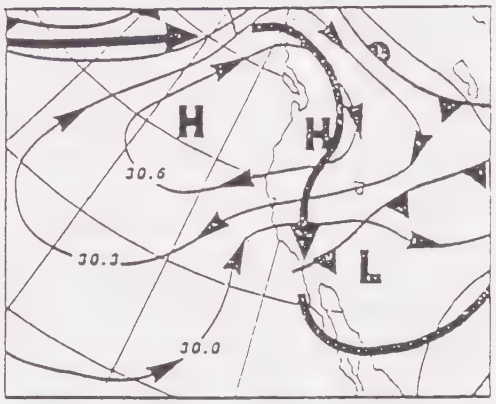
While Santa Anas are more commonly thought of as hot air from the Mojave Desert blowing into the Southland, this is not always the case. The warmer and drier winds come from high pressure areas in the Pacific Northwest, warming up as a result of the downslope. (They gain almost five degrees for every 1000 feet they descend.) Sometimes, however, as they pass through the extremely low temperatures of the Great Basin they remain cool. The coolest Santa Ana winds are those that originate with a high pressure system in Canada and bring cooler temperatures with them. (See Figure 1).

Figure 1

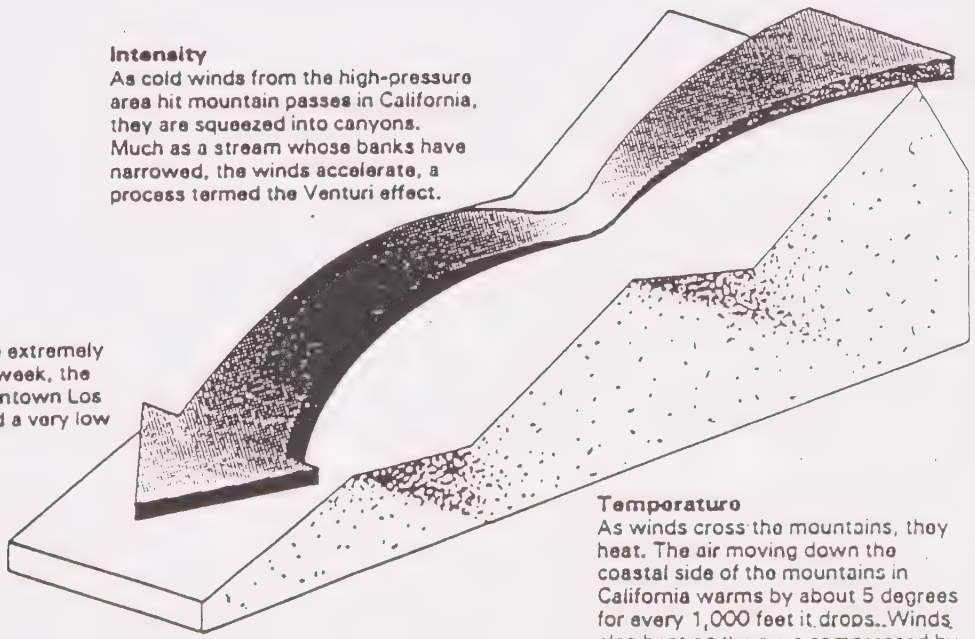
The Santa Ana Winds

THE SANTA ANA WINDS

High, cool Santa Ana winds this week have caused damage throughout the region. While Santa Anas occur at all times of the year, they are most frequent in the fall; temperatures depend largely on the source of the wind and the season. The winds this week are from the north, drawn from high-pressure zones above the Northwest through cold areas inland toward low-pressure areas in northern Mexico, much as water flows from a high point to a low point.



H High
L Low
Warm Front
Jet Stream
Cold Front



Intensity
As cold winds from the high-pressure area hit mountain passes in California, they are squeezed into canyons. Much as a stream whose banks have narrowed, the winds accelerate, a process termed the Venturi effect.

Humidity
These winds are extremely dry. Earlier this week, the humidity in downtown Los Angeles reached a very low 5%.

Temperature
As winds cross the mountains, they heat. The air moving down the coastal side of the mountains in California warms by about 5 degrees for every 1,000 feet it drops. Winds also heat as the air is compressed by passing through narrow canyons.

TRACY CROWE / Los Angeles Times

Santa Anas' destructive nature is a result of their tremendous velocity. This characteristic occurs as the winds are drawn through Southern California's mountain passes where they are compressed by the narrow canyon walls. This is why the winds are at their most severe at the foot of the canyons and passes. The winds get their name from the mountains and canyons they rip through.

While the Santa Ana is blowing, the basin generally has no smog problem but that is probably the only positive aspect of these winds. The directly-caused destructiveness of the winds has already been outlined. However, the indirectly caused hazards merit further examination. Increased fire hazard and wind erosion and blowsand are of special concern.

According to the California Department of Forestry, California's "devil winds" (Santa Anas) are the most critical weather element contributing to the start and spread of uncontrolled fires in the State. Winds supply fresh oxygen to fires, quicken their spread by carrying burning fire brands and bending flames forward while further increasing air temperatures and dehydrating both the air and available fuels. Turbulent and erratic wind conditions exemplified by a Santa Ana condition also hinder firefighters on the ground by causing unpredictable fire fronts and render the use of aircraft difficult to impossible. Many of the State's most disastrous fires have occurred during extreme fire conditions that were precipitated by the onset of the Santa Anas. The effects of wind on fire are discussed extensively in the Fire section.

Wind erosion most commonly occurs when barren sand or sandy loam soils are exposed to high wind in the absence of moisture. Alluvial fans, vacant agricultural land and sandstone cliffs in arid locations are especially prone to wind erosion, although it is not limited to these areas. Human activity can increase wind erosion by disrupting soil formations and compaction, disturbing the stabilizing and windbreaking effect of dunes, and most significantly, removing surface vegetation and its stabilizing effects.

Blowsand, the most severe form of wind erosion, occurs largely due to natural conditions. Blown sand can cause significant damage to property, and also results in the nuisance and expense of removing sand from roadways and other property, where it interferes with normal activity. In addition, blowsand introduces a high level of suspended particulates into the air, obscuring visibility and creating respiratory problems.

SECTION II. CURRENT STATUS

A. Source of Data

While there is a large body of information on wind as an energy source, there is relatively little information on wind as a hazard. Mapping of wind hazard areas in the County is sketchy and incomplete. The Uniform Building Code designates areas for wind load consideration, however, it is very generalized. When the California Highway Patrol closes highways or issues warnings for certain areas these are subjective decisions based on the opinion and/or experience of the officers on duty. The City of San Bernardino has designated high wind areas as a district with special building requirements. However, such mapping is not available on a Countywide scale.

Areas of potential wind erosion are mapped for the Valley area of the County by the Soil Conservation Service. In addition, areas of potential wind erosion and blowsand areas will be shown in the Soils section.

B. Existing Conditions

The County of San Bernardino is one of the most severely affected by Santa Ana wind conditions. The entire Valley area lies at the foot of the narrow passes and canyons that these winds come howling through from the north. A rereading of the headlines that appeared in the introduction to this report, how some of the effects these winds have had on the County in the last several years. Figure 2 catalogs a sampling of the effects of the Santa Ana winds in the County.

The notorious Panorama fire was fanned by up to 100 mph winds proving that San Bernardino County is critically affected by winds, especially in relation to fire. Fire was only one of many occurring hazards historically that, juxtaposed with a Santa Ana wind condition, caused millions of dollars of damage to property and resulted in loss of life. For more information, see the "Fire section."

San Bernardino County is also affected by wind erosion and blowsand. All soils that are newly plowed (or graded) will be more severely affected by wind erosion in the event of a Santa Ana condition. An example of wind erosion in the West End Resource Conservation District is depicted in Figure 3. Therefore, as more land area is developed and land coverings restored or replaced by structures in non-agricultural uses, the impact of wind erosion will decrease. Consequently, some of the hazards associated with strong winds will become less critical than in existing predominantly agricultural areas where soil conservation and crop protection have been of concern.

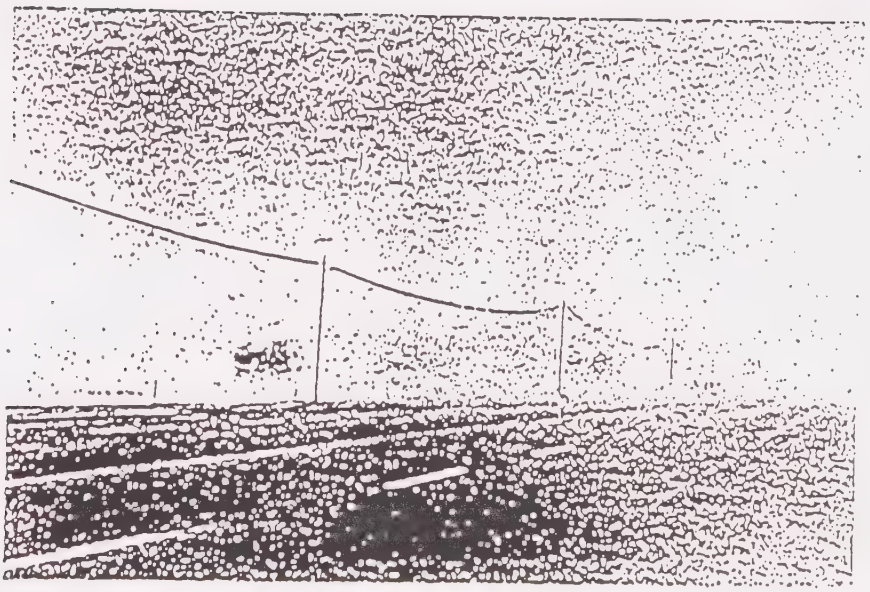
Figure 2

THE EFFECTS OF SANTA ANAS IN SAN BERNARDINO COUNTY

DATE	MAXIMUM	RESULT	EFFECT
12/21/77	62 mph	overturned trucks, traffic accidents	closed highways
11/17/80	90 mph	7 fires, toppled trees, toppled powerline	3000 + acres burned, 60,000 + acres damage, crushed car/injury, power outages, Chino Airport closed
11/22/80	100 mph	Panorama Fire	23,600 acres, $40 million property damage, 284 homes lost, 4 people killed
2/22/81	"gale force"	blew off roofs	injuries, 14 homes damaged
1/8/82	100 mph	blew off roofs, 9 trailer rigs toppled, trees down, powerlines down	5 homes major damage, minor injuries, 2 homes crushed, schools closed
12/1/82	60 mph	downed trees	vehicle damage, power outages
12/8/82	80 mph	flying debris, windows shattered, airplanes blown loose, mobile home blown from foundation	power outages, schools closed, Rialto Airport damage, $20,000 damage-Chino Airport
12/23/82	unknown	major powerline toppled	3 State power failure (Cal., Ariz., Nev.)
12/13/83	60 mph	15 car collision, downed powerlines	highway closures, power outages
1/3/84	60 mph	downed powerlines, roofs blown off, fire	power cut to 10,000, $75,000 damages
1/27/84	69 mph	uprooted trees, transformer fire, windows blown out, blowing construction site dust causes traffic accidents	2 injured, 46,400 no power, 5 injured-15 vehicles involved, flights diverted from Ontario, Norton closed-3 hours
1/28/84	70 mph	wind-whipped fires	5 homes destroyed
12/14/84	70 mph	dust storm	23 car collision
10/16/85	50 mph	fires out of control	60,000 acres, 22 homes lost in Southern California
2/18/88	78 mph	downed powerlines, 5 toppled trucks	100,000 without power, wind advisories
2/19/88	70 mph	blowing sand-Mojave Desert downed powerlines	wind advisories, low visibility, 2,000 without power
2/20/88	70 mph	trees down, flying debris	23 schools close, 44,000 without power
4/1/88	45 mph	gusty winds, 6 fires	fire season open 45 days early, over 35 acres burned

Figure 3

WIND EROSION IN THE WEST END RESOURCE CONSERVATION DISTRICT



Blowsand areas are of concern is some portions of the Desert areas of the County. However, blowsand is not the only wind-caused erosion of concern in the Desert. Whenever the desert pavement is disturbed, whether by man or his machines (especially grading and the use of off-road vehicles), the fragile protective cover is destroyed resulting in susceptibility to wind erosion.

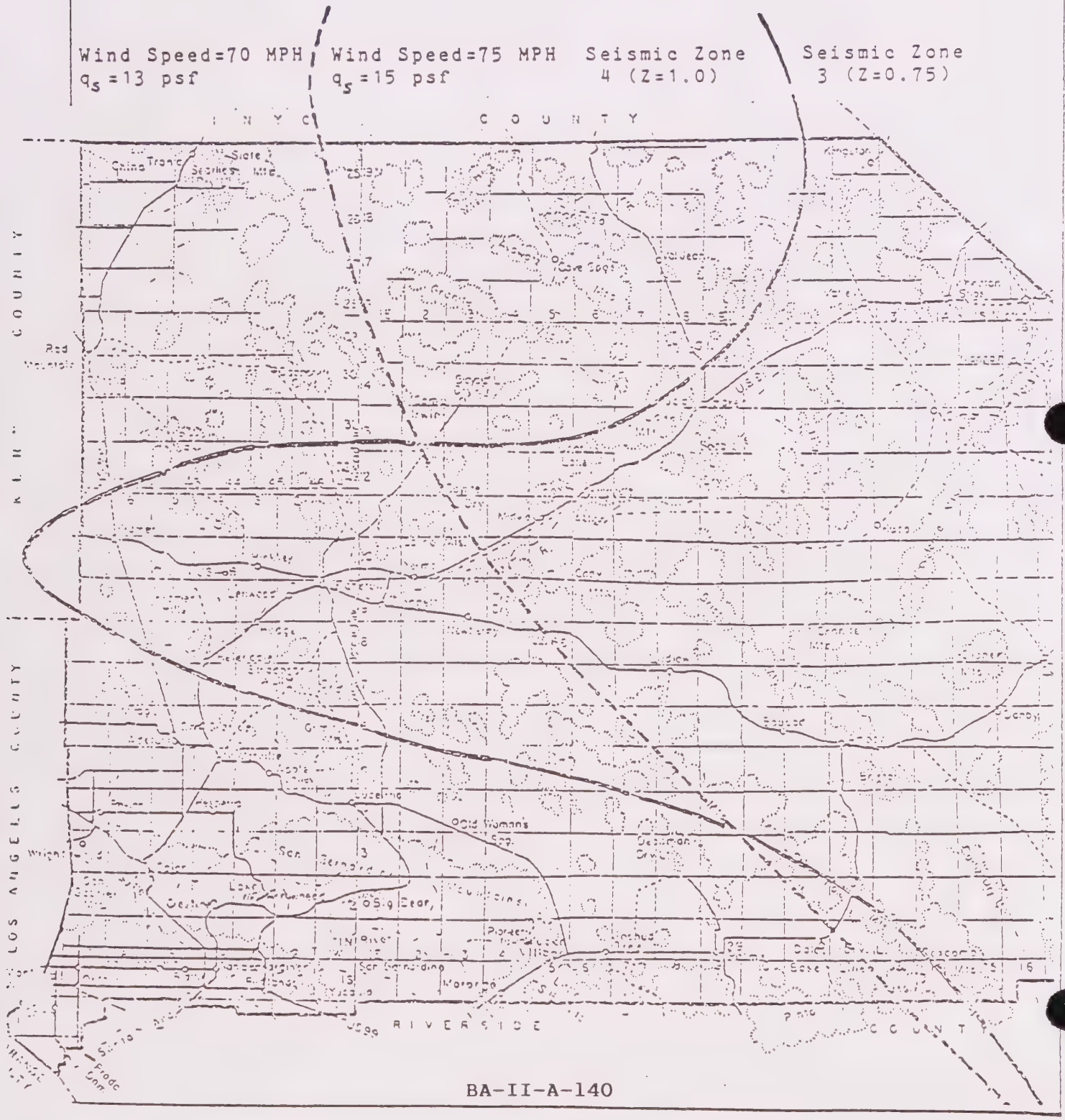
Figure 4

San Bernardino County
LAND MANAGEMENT DEPARTMENT
OFFICE OF BUILDING AND SAFETY
EPWA

No. B-2 Page 1 of 1
[Formerly U-2312(c)Figure 1]
Effective 7/13/77 Revised 1/12/83

Larry L. Schoellkopf, P.E.
Building Official

BASIC WIND SPEED (MPH) AND SEISMIC ZONE MAP OF SAN BERNARDINO COUNTY
(From Fig.No.1 & Fig. 4 U.B.C.1982 Edition)



BA-II-A-140

References

1. Armstrong, Cathy, "Santa Anas: Hot, dry and often destructive", San Bernardino County The Sun, October 16, 1985.

2. California Department of Forestry, "Fire Safe California's Wildlife Dangers," 1987.

3. California Department of Water Resources, California Wind Atlas, Contract Number P-500-82-044, April, 1985.

4. Environmental Public Works Agency, National Conference on Urban Erosion and Sediment Control, EPA 905/9-80-002, January 1980.

5. McGraw, Carol, "As Legend Has It, Santa Ana Means an Ill Wind Blows,". Los Angeles Times, February 20, 1988.

SECTION II

MAN-MADE HAZARDS

NOISE

NOISE

All substantiating data is located in the complete Noise Element (under separate cover). It is also an adopted part of the General Plan Update.

AVIATION SAFETY

AVIATION SAFETY

INTRODUCTION

Airports present special hazards that must be incorporated into the General Plan to ensure land use compatibility. One of these hazards is noise which is covered more thoroughly in the background report on that issue. Another is airport safety. Because airports in the County do not own or control all the land necessary to ensure the safety of their operations, land use planning must include airport safety considerations.

SECTION I. DEFINITION

There are two basic components of airport safety-- the safety of those in the aircraft and the safety of those on the ground. The first involves protection of airspace required for safe aircraft operation. The second deals with compatibility of surrounding land uses in terms of exposure of people on the ground to crash hazards associated with aircraft.

A. Safety in the Air

Protection of airspace is most commonly accomplished through restrictions on structure height. Under Federal Aviation Regulations (FAR) Part 77, height restrictions for development within approach and take off patterns were established to allow aircraft maneuvering room and to ensure that neither the operating capability of the airport during Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) weather nor the usable runway length is adversely affected by obstructions in the surrounding airspace.

VFR flying is conducted during good weather (when visibility is at least three miles and the ceiling is at least 1,000 feet above the ground). Under VFR flight rules, the pilot is responsible for seeing and avoiding objects in his flight path. There are three specific points when a pilot is especially concerned with surface objects:

1. When climbing after take off,
2. When operating at a low altitude, and
3. When descending in preparation of landing including flight in an airport traffic pattern.

Tall structures within departure path areas could cause collision with aircraft or result in distraction of the pilot's attention at take off, a crucial time. These structures can also affect aircraft operations safety if the aircraft loses power at take off. An aircraft's ability to climb can be forfeited or severely hampered if an engine fails. Buildings would then be brought into more immediate proximity than would occur under normal take off conditions. The same concerns are generally applicable during the landing phase with height restrictions enforced within the glide path of an approaching aircraft. The possibility of a pilot undershooting the approach should also be considered. An object or structure could become a concern if it is located within 300 feet of normal airport traffic pattern altitude. This altitude is set by the airport operator and ranges from 800 to 1500 feet above ground level.

However, structure height concerns are not restricted to airport airspace. Pilots frequently navigate using both electronic navigational aids and visual references to landmarks (railroads, highways, coastlines, rivers, valleys, etc.) when flying between airports. Taken together all these visual and electronic aids form a network of VFR flyways. When the weather is marginal, pilots fly at low altitudes to maintain visual contact with the ground. At this time, tall structures can affect aircraft operations along the flyway. The VFR flyways are considered to encompass about two statute miles on either side of the flight path. In most cases, an object over 500 feet would be of concern within a VFR flyway. Communication antennas are most commonly problem causers in these corridors. In fact, the original need for federal airspace obstruction standards was the result of this type of encroachment.

IFR operations are required when weather conditions preclude the use of visual references restricting pilots to electronic navigational aids both on the ground and in the air. These operations follow a specified set of instrument flight procedures established by the Federal Aviation Administration (FAA). These procedures are straight in approach, circling approach, missed approach and various types of departures. Each procedure specifies a set of minimum conditions. The elements of these conditions are:

1. Minimum Descent Altitude (MDA) or
2. Decision Height (DH) and
3. Weather conditions including visibility and possibly a ceiling value.

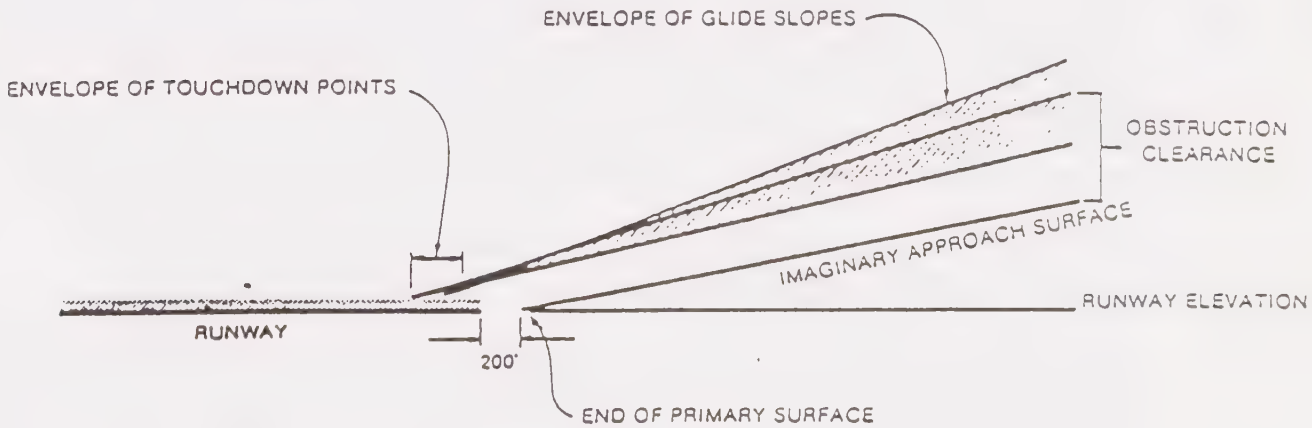
These minimums vary from airport to airport. Structures located in the landing and take off areas used for instrument arrivals and departures may cause the FAA to alter its procedures thereby reducing the utility of the airport. When the weather minimums must be raised, airports can be effectively shut down as a result of weather conditions below those prescribed minimums for

additional amounts of time each year. Procedures that may be affected included existing and future instrument arrival or departure procedures. Airport utility is thereby decreased.

Tall structures can also result in the imposition of climb gradients. Using a procedure with a climb gradient requires that aircraft must be able to achieve a higher rate of climb than would otherwise be necessary to clear obstacles in the departure path. Certain aircraft incapable of achieving that gradient would be precluded from airport use or might have to severely restrict their payload to achieve sufficient altitude. Again, airport utility can be decreased.

To establish obstruction standards various imaginary surfaces are projected. They differ for civil airports, military airports and heliports. For civil airports, they include primary, approach, horizontal, transitional, and conical surfaces. Military airports include primary, clear zone, inner horizontal, conical, outer horizontal, approach, clearance, and transitional surfaces. Heliport imaginary surfaces consist of heliport primary, approach, and transitional surfaces. Imaginary surfaces are determined by the length of the airport runways and the most precise approach-existing or future - for each runway end. Depictions of these imaginary surfaces show the permissible height of objects and structures at different locations within the surfaces. The imaginary approach surfaces in Part 77 also allow for a margin of safety. Figure 1 provides a visual representation of that margin. In addition, the horizontal surface usually starts at 150 feet above the airport elevation while normal traffic pattern altitude is 800 to 1500 feet, providing a significant altitude buffer between the traffic pattern and the horizontal surface.

Figure 1



THEORETICAL OBSTRUCTION CLEARANCES PROVIDED BY PART 77 IMAGINARY APPROACH SURFACES

B. Safety on the Ground

The safety of those on the ground is also important when planning adjacent to airports. The risk of aircraft crashes is a significant consideration, particularly near military bases where pilots are trained to use high performance jet aircraft. The size of the area affected by a crash and the ability to predict its impact and location varies with the type of aircraft. Most problems are expected to occur within normal flight patterns, but any disabled aircraft may choose to take a straight in approach to any runway.

It is assumed that the degree of hazard associated with different land uses is related to the intensity of human occupancy, and possibly with the inherent volatility associated with some uses. Consideration must be given to the potential for property damage, as well as risk caused by obstacles which might interfere with emergency landings. Safety for those on the ground is maintained, therefore by attempting to restrict high density population and uses involving critical substances or facilities under heavily used flight paths leading to and from the airport. However, there are no federally or state mandated criteria for this action. The Military, in their Air Installation Compatible Use Zone (AICUZ) studies have established areas called Accident Potential Zones (APZs) extending beyond the Clear Zone as far as ten thousand feet (for instrument runways), and they recommend that these areas be carefully monitored for land uses that restrict density of population. However, there are no such consistent criteria for establishing similar areas around civil airports. In some areas, recommendations for crash hazard zones rate areas where the risk of crash is greatest. Figure 2 gives an example of crash hazard zones in Irvine. Figure 3 illustrates possible density standards for each of the crash hazard zones shown in Figure 2. These standards suggest maximum allowable density for land uses in the crash hazard zones both on the basis of the type of land use and overall density. The suggested zones establish very stringent criteria for land uses in the crash hazard zones (Figures 4 & 5). Final determinations in establishment of such zones or any other land use controls should be based on detailed studies for individual airports.

C. The Airport Land Use Commission

Such studies and the establishment of the hazard zones are within the scope of responsibility of the Airport Land Use Commission (ALUC). Recognizing that phenomenal growth of commercial aviation has stretched airport capacities to the point where the loss of any facility and the resultant decrease in capacity has become a major problem and also that continued residential development adjacent to airports threatens the viability of the airport as well as the health and safety of the nearby residents, the State Legislature, in 1967, enacted a law creating the ALUCs. They



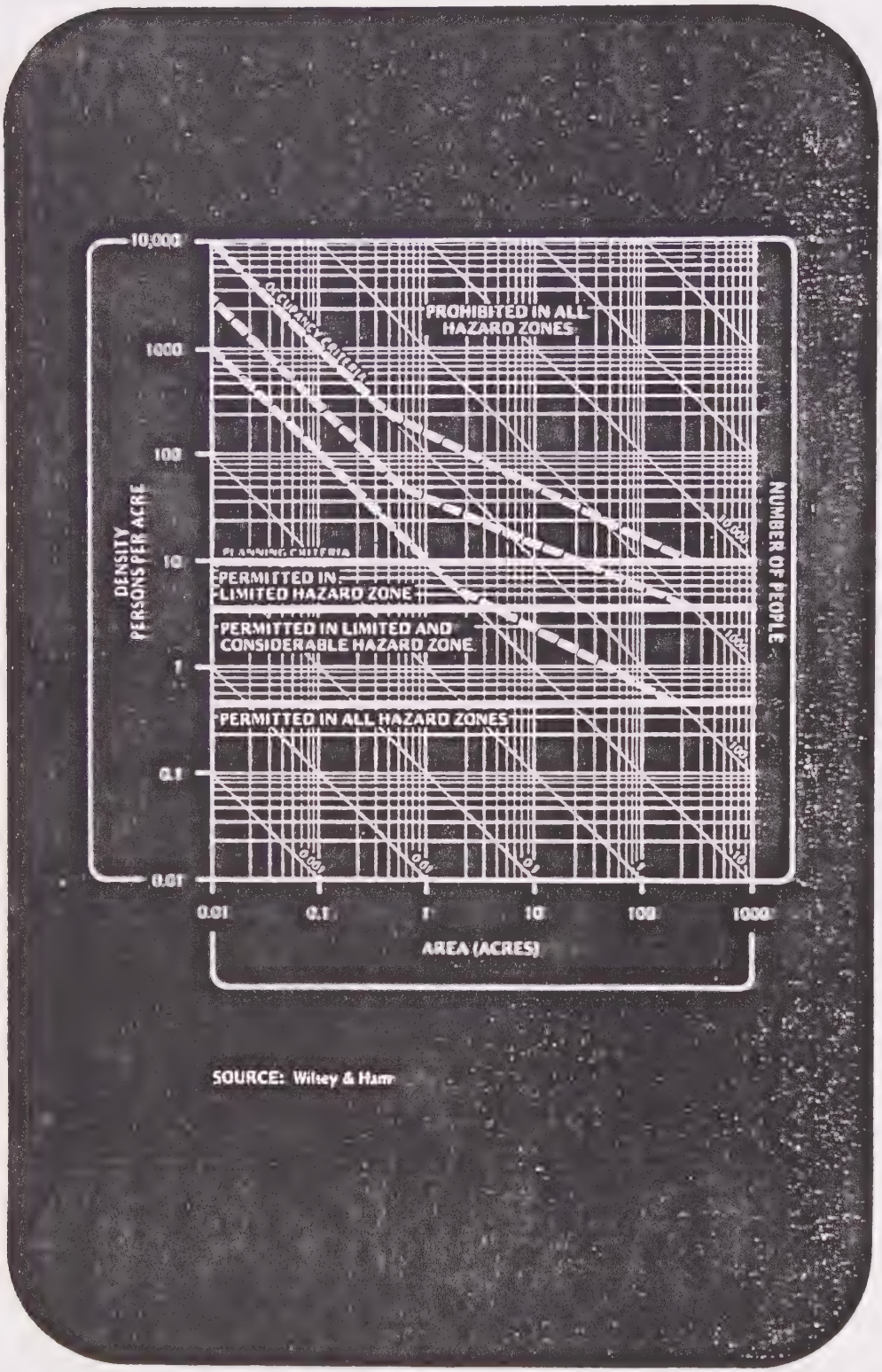
AIRCRAFT NOISE & CRASH HAZARDS

- 65 C.N.E.L.
- 'A' EXTREME CRASH HAZARD
- 'B3' CONSIDERABLE CRASH HAZARD HIGH NOISE IMPACT
- 'B2' CONSIDERABLE CRASH HAZARD MODERATE NOISE IMPACT
- 'C3' LIMITED CRASH HAZARD HIGH NOISE IMPACT
- 'C2' LIMITED CRASH HAZARD MODERATE NOISE IMPACT
- 'D3' MINIMAL CRASH HAZARD HIGH NOISE IMPACT
- 'D2' MINIMAL CRASH HAZARD MODERATE NOISE IMPACT
- ..... SCHOOL CONSTRUCTION LIMIT

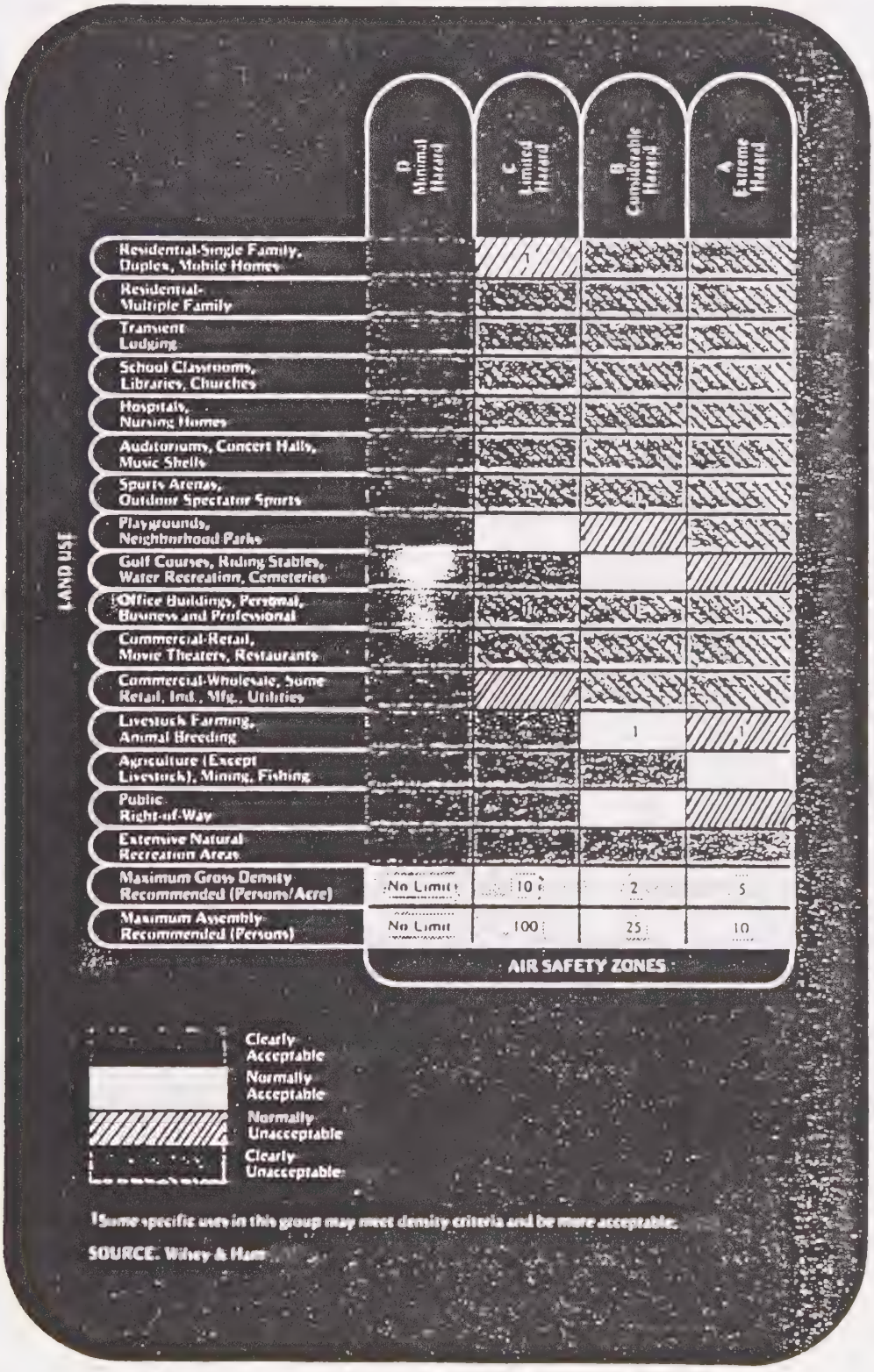
SOURCE CITY OF IRVINE 12/73

- CITY BOUNDARIES
- SPHERE OF INFLUENCE

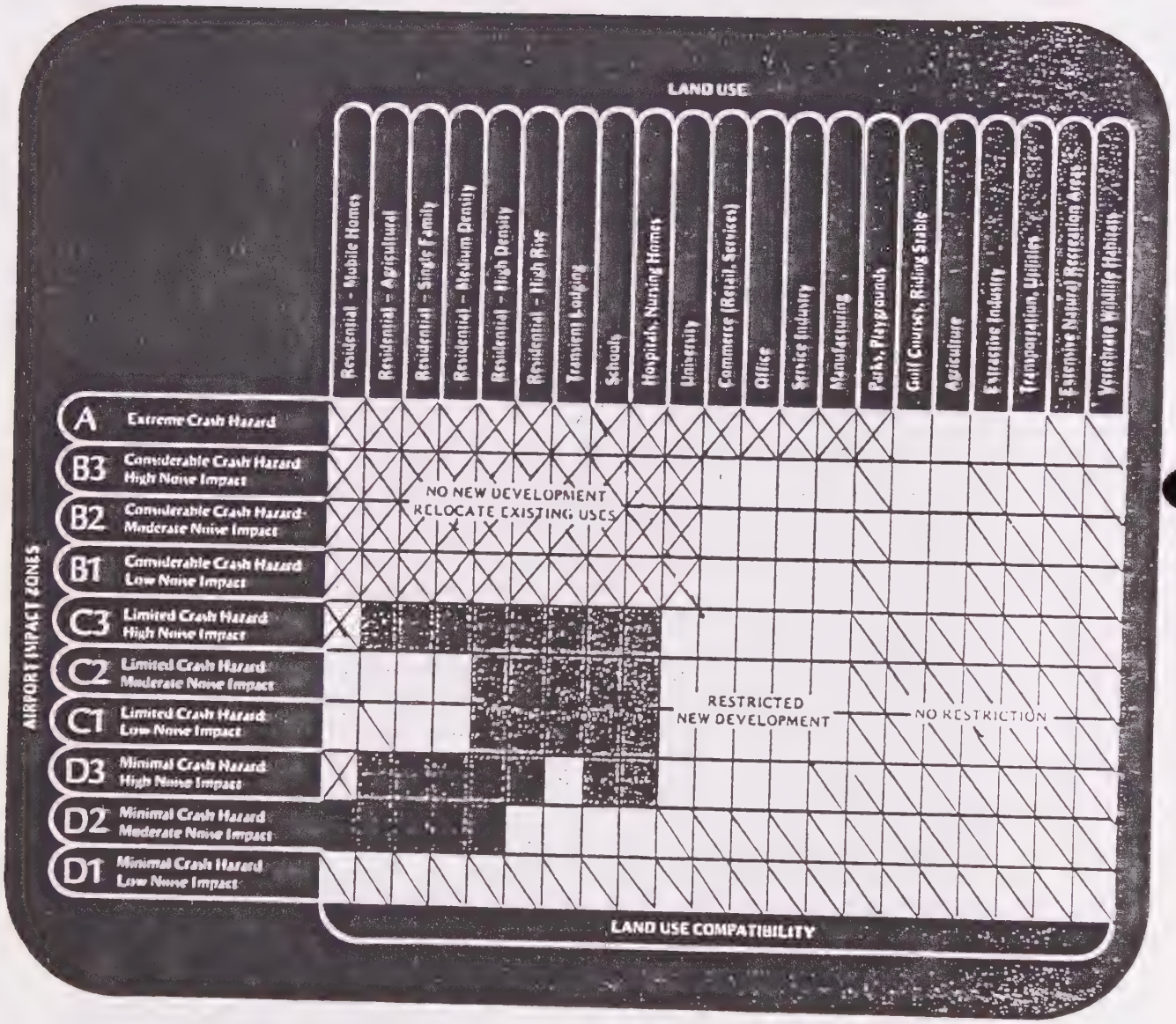
SUGGESTED DENSITY CRITERIA



LAND USE SUITABILITY IN AIR SAFETY ZONES



AIRPORT IMPACT ZONES AND LAND USE COMPATIBILITY



were mandated for each county in the State that is served by a certified air carrier from a public use airport to provide for the orderly development of public airports and to promote public health, welfare, and safety through land use planning activities. State law specified that the ALUC be composed of seven members: two representing cities; two representing the County; two representing airport operators; and one representing the public (Public Utilities Code Section 21670 (b)). As an alternative, the responsibilities of the ALUC may be assigned to another agency, such as a council of governments or the County's planning commission (Public Utilities Code Section 21670.1). The statutes pertaining to ALUC activities and responsibilities have been revised several times over the years, but the most significant changes occurred in 1982 with the enactment of AB 2920 by the State Legislature.

The basic duties of the ALUC, as described in the enabling legislation and its revisions, are as follows:

(a) To assist local agencies in ensuring compatible land uses in the vicinity of all new airports and in the vicinity of existing airports to the extent that the land in the vicinity of those airports is not already devoted to incompatible uses.
(b) To coordinate planning at the state, regional, and local levels so as to provide for the orderly development of air transportation, while at the same time protecting the public health, safety, and welfare.
(c) To prepare and adopt an airport land use plan pursuant to Section 21675.
(d) To review the plans, regulations, and other actions of local agencies and airport operators pursuant to Section 21676.
(e) The powers of the commission shall in no way be construed to give the commission jurisdiction over the operation of any airport.
(f) In order to carry out its responsibilities, the commission may adopt rules and regulations consistent with Article 3.5 Airport Land Use Commission.

Until the passage of AB 2920, in 1982 the ALUCs were basically advisory, although they were empowered to withhold approval on incompatible land uses. AB 2920 did not change their approval/disapproval responsibilities, but it further charged them with the preparation and adoption of airport environs land use plans. While there are no detailed state regulations for the content of these plans they generally contain:

1. A description of existing and proposed airport facilities.
2. A description of current and projected airport operations (e.g., type of aircrafts, number of flights).

3. An inventory of the areas potentially affected by airplane crashes (i.e. safety zones).
4. An inventory of the areas affected by aircraft noise (i.e. noise contours).
5. A description of present land use within these affected areas.
6. Policies and standards for land use and development within the planning boundaries to minimize safety hazards and noise problems (e.g., compatible land uses, height limitations, noise insulation standards).
7. Specific measures for coordinating city and county land use planning and development regulations, including referral areas.

Effective January 1, 1989, the powers and duties of the ALUC will be as follows:

1. To study conditions and make recommendations concerning the need for height restrictions on buildings near airports.
2. To make recommendations for the use of land surrounding airports to assure the safety of air navigation and the promotion of air commerce.
3. To hold public hearings regarding the above provisions and to advise the involved jurisdictions of the commissions findings.
4. To use zoning to assure compatible land uses in the vicinity of all new and existing airports to the extent that the land is not already devoted to incompatible uses and to this end, require that all new construction shall conform to the noise standards adopted by the State Department of Transportation.

As mentioned above, establishment of areas of special review designed to protect both people in the air and people on the ground is the responsibility of the ALUC. These areas, designated with the FAR 77 criteria previously mentioned and other standards similar to those established in Irvine, become the ALUC's Area of Influence. Once the Area of Influence is developed, the ALUC must apply certain compatibility criteria to every proposed development or zoning change within that area. A matrix of land use categories is generally adopted and refined where necessary to reflect any peculiar or special situations within each county. (Figure 6 gives examples.)

However, knowing the boundaries of the area and the categories of compatible or incompatible land uses is insufficient. It is essential that the ALUC also have up-to-date land use maps showing exactly what is now on the land, zoning maps to show what is permissible on the land, and general plan maps showing what could be on the land in the future.

Summary of Federal Aviation Regulations Part 77

NOTICE REQUIREMENTS	OBSTRUCTION STANDARDS	DEFINITION OF SUBSTANTIAL ADVERSE EFFECT
Notice of construction or alteration is required if an object:	Existing or future object would be an obstruction if it:	Evidence of substantial adverse effect(s) normally requires the issuance of an FAA Determination of Hazard to Air Navigation, i.e.
(1) is greater than 200 feet in height above ground level at its site.	(1) is greater than 500 feet in height above ground level at site.	(1) IFR - An IFR operation, procedure or minimum flight altitude would require a change if the proposed structure is erected or the existing object is not altered or removed.
(2) penetrates the following imaginary surfaces: • 100:1 plane for a distance of 20,000 ft. from nearest point of nearest runway for airports with at least one runway more than 3200' long • a 50:1 plane for a distance of 10,000 feet from the nearest point of the nearest runway for airports with the longest runway no more than 3200' long • a 25:1 plane for a distance of 5000 feet from the nearest point of the landing and takeoff area for heliports	(2) for airports one runway at least 3200 feet long: is 200 feet above ground level or airport elevation (whichever is higher) for 3 nautical miles from the airport increasing 100 feet for each mile up to 500 feet.	(2) VFR - A VFR operation would be required to change from regular flight course or altitude if the proposed structure is erected or the existing object is not altered or removed.
(3) penetrates the above surfaces when adjusted upward by 17' (highway), 15' (public roadway), 10' (private roadway), 23' (railroad or waterway or other traverse way).	(3) for terminal obstacle clearance areas (including initial approach segment, departure area, and a circling approach area), does not provide the required obstacle clearance between the object and the established minimum instrument flight altitude.	(3) There would be an electromagnetic effect upon an air navigation facility.
(4) is in an instrument approach area and is requested by FAA.	(4) for the enroute obstacle clearance area of a Federal airway or approved off-airway route, would increase the minimum obstacle clearance altitude.	(4) There are approved airport improvement plans on file, and future IFR and VFR operations would be affected.
	(5) penetrates the imaginary approach, transitional, horizontal, and conical surfaces established relative to each airport's runways	(5) A significant volume of aeronautical operations would be affected.
	(6) penetrates the above surfaces when adjusted upward by 17' (highway), 15' (public roadway), 10' (private roadway), 23' (railroad), or the height of the highest object using waterways and any other traverseway.	A proposed structure or an existing object would not have a substantial adverse effect if an aeronautical study shows that: (1) An affected IFR or VFR operation can and should be changed to accommodate the object, or (2) there is no evidence of a significant volume of aeronautical operations.
		Source: Procedures for Handling Airspace Matters, FAA, February 1, 1974.

Figure 6

Since the ALUCs do not have the necessary staff or funding to develop these maps they have had to use the countywide land use, zoning and planning maps furnished by county planning departments. In remote areas these maps may not even exist, and when they are available they could be very badly out-of-date. Because of difficulties in obtaining maps specific enough and detailed enough for ALUC purposes, AB 2920 charged the ALUCs with preparing the required maps. However, without the necessary budget or manpower to follow through on this requirement, most ALUCs use the county generated general plan maps. In the case of military installations, the AICUZ study supplies detailed land use maps of the airport environs, and the ALUC will use these when applicable. But these may also be dated.

It is, therefore, evident when defining the concerns involved in airport safety, that adequate land use planning in these areas requires the cooperation of many jurisdictions and the use of a tremendous body of manpower and expertise.

SECTION II. CURRENT STATUS

A. Sources of Data

Sources used in obtaining information for this section include San Bernardino County's ALUCs and AICUZ studies for military facilities in the County. In addition, noise contours, generated for the Noise Background Report by J. J. Van Houten and Associates are also utilized where they coincide with ALUC designation of Safety Areas. For instance, Safety Area II is defined as that area outside the airport boundaries but within the 65 CNEL noise contour line.

Land use mapping is in process as part of the update process and, when completed, will be used to identify areas of land use compatibility and incompatibility.

B. Existing Conditions

There are 17 public use airports, 29 private use airports (including two Air Force Bases) and 18 heliports operating under State permit within San Bernardino County. Lists of these facilities are found in Figures 7 and 8. In addition, supersonic and low altitude flight corridors extend over much of the North Desert Area. Each of these facilities affects surrounding land uses and is affected by them.

Figure 7

VALLEY AND MOUNTAIN AERONAUTICS FACILITIES

Facility Name	Nearest City/Community	Type of Use	Safety Areas Developed?	ALUC Approved Noise Contours Developed?	Tower/Non-Tower	Annual Operations
1. Big Bear City	Big Bear City	Public Airport	Yes	Yes	Non-Tower	31,700
2. Cable	Upland	Private Airport	No	Yes	Non-Tower	140,000
3. Chino	Chino		Yes	Yes	Tower	45,660
4. Fire Orange	San Bernardino	Private Heliport	No	No	Non-Tower	Unknown
5. Kaiser Hospital	Fontana	Private Heliport	No	No	Non-Tower	Unknown
6. Kasler	Highland	Private Heliport	No	No	Non-Tower	Unknown
7. Mountains Community Hospital	Lake Arrowhead	Private Heliport	No	No	Non-Tower	Unknown
8. Loma Linda Valley Hospital	Loma Linda	Private Heliport	No	No	Non-Tower	Unknown
9. Loma Linda Valley Medical Center	Loma Linda	Private Heliport	No	No	Non-Tower	Unknown
10. Loma Linda Community	Loma Linda	Private Heliport	No	No	Non-Tower	Unknown
11. Norton AFB	San Bernardino	Military	Yes-AICUZ	Yes	Tower	41,245
12. Ontario International	Ontario	Public Airport	Yes	Yes	Tower	138,811
13. Redlands	Redlands	Public Airport	Yes	Yes	Non-Tower	56,700
14. Rialto	Rialto	Public Airport	Yes	Yes	Non-Tower	141,015
15. San Bernardino County Medical Center	San Bernardino	Private Heliport	No	No	Non-Tower	Unknown
16. San Bernardino Community Hospital	San Bernardino	Private Heliport	No	No	Non-Tower	Unknown
17. SCE Eastern Division	San Bernardino	Private Heliport	No	No	Non-Tower	Unknown
18. USFS Mill Creek	Yucaipa	Private Heliport	No	No	Non-Tower	Unknown

Figure 8

DESERT AERONAUTICS FACILITIES

Facility Name	Nearest City/Community	Type of Use	Safety Areas Developed?	AIUC Approved Noise Contours Developed?	Tower/Non-Tower	Annual Operations
1. Abraham Ranch	Lucerne Valley	Private Airport	No	No	Non-Tower	Unknown
2. Adelanto	Adelanto	Private Airport	No	No	Non-Tower	Unknown
3. Apple Valley	Apple Valley	Public Airport	No	No	Non-Tower	36,320
4. Baker	Baker	Public Airport	No	No*	Non-Tower	250
5. Barstow Daggett	Daggett	Public Airport	No	No *	Non-Tower	25,200
6. Boron	Boron	Private Airstrip	No	No	Non-Tower	Unknown
7. Camino	Needles	Private Airport	No	No	Non-Tower	
8. Conesfield	Twentynine Palms	Private Airport	No		Non-Tower	
9. Crosswinds	Twentynine Palms	Private Airport	No	No	Non-Tower	
10. Cussions	Essex	Private Airport	No	No	Non-Tower	
11. Depue	Lenwood	Private Airport	No	No	Non-Tower	
12. El Mirage Sky Ranch	Adelanto	Private Airport	No	No	Non-Tower	4,250
13. Essex Military	Essex	Private Airport	No	No	Non-Tower	Unknown
14. Four Corners	Kramer Junction	Private Airport	No	No	Non-Tower	Unknown
15. Gene Wash Reservoir	Parker	Private Airport	No	No	Non-Tower	137,605
16. George AFB	Adelanto	Military	Yes-AICUZ	No	Non-Tower	Unknown
17. Hansen	Adelanto	Private Airport	No	No	Non-Tower	Unknown
18. Hart Mine	Ivanpah	Private Airport	No	No	Non-Tower	Unknown
19. Harvard	Yermo	Private Airport	No	No	Non-Tower	Unknown
20. Helendale	Helendale	Private Airport	No	No	Non-Tower	Unknown
21. Hesperia Air Lodge	Hesperia	Private Airport	No	No *	Non-Tower	14,500
22. Hi Desert	Joshua Tree	Private Airport	No	No *	Non-Tower	21,000
23. Hi Desert Hospital	Joshua Tree	Private Heliport	No	No	Non-Tower	Unknown
24. Iron Mountain	Desert Center	Private Airport	No	No	Non-Tower	Unknown
25. Kelly Ranch	Lucerne Valley	Private Airport	No	No	Non-Tower	Unknown

Figure 8 continued

DESERT AERONAUTICS FACILITIES

Facility Name	Nearest City/Community	Type of Use	Safety Areas Developed?	ALUC Approved Noise Contours Developed?	Tower/Non-Tower	Annual Operations
26. Krey Field	Adelanto	Private Airport	No	No	Non-Tower	Unknown
27. Luft Hafen	Adelanto	Private Airport	No	No	Non-Tower	Unknown
28. MAF Airpark	Twentynine Palms	Private Airport	No	No	Non-Tower	Unknown
29. Needles	Needles	Public Airport	No	No *	Non-Tower	14,500
30. Pacific Telephone	Baker	Private Heliport	No	No	Non-Tower	Unknown
31. Palisades Ranch	Helendale	Private Airport	No	No	Non-Tower	Unknown
32. Roy's	Amboy	Private Airport	No	No	Non-Tower	Unknown
33. San Bernardino County	Yucca Valley	Private Heliport	No	No	Non-Tower	Unknown
34. SCE Barstow Service Center	Barstow	Private Heliport	No	No	Non-Tower	Unknown
35. SCE Lugo Station	Hesperia	Private Heliport	No	No	Non-Tower	Unknown
36. SCE Solar I	Yermo	Private Heliport	No	No	Non-Tower	Unknown
37. SCE Victorville Service Center	Victorville	Private Heliport	No	No	Non-Tower	Unknown
38. SCE Yucca Valley	Yucca Valley	Private Heliport	No	No	Non-Tower	Unknown
39. Shehorn Ranch	Yucca Valley	Private Airport	No	No	Non-Tower	Unknown
40. Soggy Dry Lake	Lucerne Valley	Private Airport	No	No	Non-Tower	Unknown
41. Sun Hill Ranch	Adelanto	Private Airport	No	No	Non-Tower	210
42. Sutton Ranch	Adelanto	Private Airport	No	No	Non-Tower	Unknown
43. Trona	Trona	Public Airport	No	No *	Non-Tower	7,100
44. Twentynine Palms	Twentynine Palms	Public Airport	No	No *	Non-Tower	28,200
45. Vidal Junction	Vidal Junction	Private Airport	No	No	Non-Tower	Unknown
46. Williamson	Phelan	Private Airport	No	No	Non-Tower	Unknown
47. Yucca Valley	Yucca Valley	Private Airport	No	No *	Non-Tower	12,400

* Noise Contours developed by J. J. Van Houten & Associates for San Bernardino County Noise Element.

In response to this condition and state requirements for ALUCs, the County formed three airport land use commissions: East Valley, West Valley, and Mountain-Desert ALUCs. In 1973, interim ALUC plans were adopted for the East and West Valley ALUC's. Their adoption occurred primarily to meet the State requirement for Airport Land Use Plans. They were adopted as interim documents to give the County time to design a Model Airport Land Use Plan and to acquire the funds and staff necessary to do the plans for the many airports within the County. Two model plans (Cable and Big Bear Airports) were developed with the assistance of the California Transportation Department, Aeronautics Division. However, before fully developed Airport Land Use Planning Programs could be established, Proposition 13 was passed and the program was shelved. No plan, interim or otherwise was adopted to apply to the fifteen recognized airports in the desert. Only a minimal amount of staff time was budgeted to meet the requirements for service of projects around airports.

However, in September, 1982, when AB 2920 became effective, reevaluation was necessary. Interim plans to meet the mandated General Plan consistency requirement had to be formulated for all three ALUCs. Because the General Plan (adopted in 1979) was the most recent land use document available, the ALUCs had utilized it for project review. But AB 2920 required that the ALUC Plan take precedence over the General Plan. The solution was for the ALUCs to adopt the General Plan as the official interim plans. Each ALUC adopted the Consolidated General Plan Land Use as the Interim Airport Land Use Plans with special review guidelines and some appended maps for the Mountain-Desert ALUC (Military installation safety mapping was added). AICUZ maps are still used for all military installations. In addition, definitions for Safety Areas I, II and III were adopted for airports and heliports with a Safety Area IV added for military airports.

It must be emphasized that these plans were adopted only as an interim measure until such time as funds and staff can be appropriated to design comprehensive airport land use plans that can be adopted and placed into service.

Glossary

Accident Potential Zones (APZs): Designated areas of higher likelihood of accidents; accident potential zones for military airports are developed by reviewing the accident history of the airport, usually as part of an AICUZ study.

Airport Land Use Commission (ALUC): A State-authorized body existing in each county having the responsibility to develop plans for achieving land use compatibility between airports and their environs.

Air Installation Compatible Use Zone (AICUZ): Department of Defense programs established by Department of Defense Instruction 4165.57 "Air Installation Compatible Use Zones", November 8, 1977.

Airspace: That area lying above the ground or water

Approach Surface:

a. civil airport: A surface longitudinally centered on the extended runway centerline and extending outward and upward from each end of the primary surface is called an "approach surface." It is applied to each end of a runway based on the type of available or planned approach.

b. military airport: An inclined plane, symmetrical about the extended runway centerline, beginning 200 feet beyond each end of the primary surface at the centerline elevation of the runway end and extending for 50,000 feet. The slope of the approach clearance surface is 50 to 1 along the runway centerline extended until it reaches an elevation of 500 feet above the established airport elevation. It then continues horizontally at this elevation to a point 50,000 feet from the point of beginning. The width of this surface at the runway end is the same as the primary surface, it flares uniformly, and the width at 50,000 feet is 16,000 feet.

c. heliport : The approach surface begins at each and of the heliport primary surface with the same width as the primary surface, and extends outward and upward for a horizontal distance of 4,000 feet where its width is 500 feet. The slope of the approach surface is 8 to 1 for civil heliports and 10 to 1 for military heliports.

Ceiling: The height above the ground of the base of the lowest layer of clouds when over one half of the sky is obscured.

Clear Zone: Defined in Federal Aviation Regulations, Part 152.9(b): an area at ground level, extending beyond the runway primary surface and underlying the approach surface; these zones, which include all of the area out to a point where the approach surface reaches 50 feet above ground level, are presented in detail on the Airport Layout Plan for each airport. The federal government requires that the airport owner have an "adequate property interest" in the clear-zone area in order that the requirements of FAR Part 77 can be met and the area protected from future encroachments. Adequate property interest may be in the form of ownership in fee simple (the most preferred) or lease (provided it is long term) or any other demonstration of legal ability to prevent future obstructions in the runway clear zone.

Clear Zone Surface (military airports): A surface located on the ground or water at each end of the primary surface, with a length of 1,000 feet and the same width as the primary surface.

Climb Gradient: The rate of climb of an aircraft, express in feet per nautical mile.

Conical surface:

a. civil airport: A surface extending outward and upward from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet is known as a "conical surface".

b. military airports: A surface extending from the periphery of the inner horizontal surface outward and upward at a slope of 20 to 1 for a horizontal distance of 7,00 feet to a height of 500 feet above the established airfield elevation.

Decision Height (DH): The height, specified in feet above MSL, above the highest runway elevation in the touchdown zone at which a missed approach shall be initiated if the required visual reference has not been established. The decision height applies only where an electronic glide slope provides the reference for descent, as in ILS or PAR.

FAR Part 77: Establishes standards for determining obstructions in navigable airspace, sets forth requirements for notice of proposed construction or alteration and provides for aeronautical studies of obstructions or air navigation.

Federal Aviation Administration (FAA): A federal agency charged with regulating air commerce to promote its safety and development, encouraging and developing civil aviation, air traffic control, and air navigation and promoting the development of a national system of airports.

Federal Aviation Regulations (FAR): Regulations issued by the FAA to regulate air commerce; issued as separate "Parts", e.g., Part 77.

Flight Path: Aircraft routes from one airport to another.

Flyway: The flight path plus two statute miles on either side of the normal flight path.

Horizontal surface:

a. civic airports: A "horizontal surface" is a horizontal plane 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs of specified radii form the center of each end of the primary surface of each runway and connecting the adjacent arcs of lines tangent to those arcs.

b. military airports:

1. Inner Horizontal Surface. A plane oval in shape at a height of 150 feet above the established airfield elevation. The plane is constructed by scribing an arc with a radius of 7,500 feet above the centerline at the end of each runway and interconnecting these arc with tangents.

2. Outer Horizontal Surface. A place located 500 feet above the established airfield elevation, extending outward from the outer periphery of the conical surface for a horizontal distance of 30,000 feet.

Imaginary Surfaces: Surfaces established in relation to the end of each runway or designated takeoff and landing area (for heliports), as defined in paragraphs 77.25, 77.28 and 77.29 of FAR Part 77 "Objects Affecting the Navigable Airspace." Such surfaces include imaginary approach, horizontal, conical, transitional, primary and other surfaces.

Instrument Flight Rules (IFR): Rules governing the procedures for conducting flight under instrument meteorological conditions.

Minimum Descent Altitude (MDA): The lowest altitude to which descent shall be authorized in procedures not using a glide slope. Aircraft are not authorized to descend below the MDA until the runway environment is in sight, and the aircraft is in a position to descend for a normal landing. The MDA is expressed in feet above MSL and is determined by adding the required obstacle clearance to the MSL height of the controlling obstacle.

Obstruction: Any object of natural growth, terrain, or permanent or temporary construction or alteration, including equipment or materials used there in the height of which exceeds the obstruction standards of subpart C of FAR Part 77 "Objects Affecting Navigable Airspace".

Primary Surface

a. civil airport: A surface longitudinally centered on a runway is called a "primary surface". When the runway is paved the primary surface extend 200 feet beyond each end of the runway. The width of the primary surface varies between 250 feet and 1,000 feet depending on the type of approach.

b. military airport: A surface located on the ground or water longitudinally centered on each runway with the same length as the runway. The width of the primary surface for runways is 2,000 feet.

c. heliport: The area of the primary surface coincides in size and shape with the designated takeoff and landing area of a heliport. This surface is a horizontal plane at the elevation of the established heliport elevation.

Public Use Airport: Publicly or privately owned airport that offers the use of its facilities to the public without prior notice or special invitation or clearance, and that has been issued a California Airport Permit by the Division of Aeronautics of the California Department of Transportation.

Safety Zone(s)" The area(s) in the vicinity of an airport in which land use restrictions are established to protect the safety of the public.

Statute Mile: 5,280 feet (as opposed to nautical mile - 6076 feet)

Transitional Surface:

a. civil airports: These surfaces extend outward and upward at right angles to the runway centerline plus runway centerline and extended at a slope of 7 to 1 from the sides of the primary surface and from the sides of the approach surfaces.

b. military airports: These surfaces connect the primary surfaces, the first 200 feet of the clear zone surfaces, and the approach clearance surfaces to the inner horizontal surface, conical surface, outer horizontal surface or other transitional surfaces. The slope of the

transitional surface is 7 to 1 outward and upward at right angles to the runway centerline.

c. heliports: These surfaces extend outward and upward from the lateral boundaries of the heliport primary surface and from the approach surfaces at a slope of 2 to 1 for a distance of 250 feet measured horizontally from the centerline of the primary and approach surfaces.

Visual Flight Rules (VFR): Flight rules that identify conditions when weather is adequate for aircraft to maintain safe separation by visual means. Under VFR conditions safe separation between aircraft is responsibility of the pilot.

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County of San Bernardino, Department of Airports, County Airport System Plan, 1971.

Metropolitan Transportation Commission and Association of Bay Area Governments, Airport Land Use Planning Handbook, California Department of Transportation, Division of Aeronautics, July 1983.

Office of Planning and Research, General Plan Guidelines, State of California, 1987.

Rawlings Enterprises, Southern California Association of Governments. General Aviation Systems Study - Phase II, SCAG, December, 1987.

HAZARDOUS WASTE

HAZARDOUS WASTE/MATERIALS

The San Bernardino County Hazardous Waste Management Plan (under separate cover) is the Background Appendix regarding Hazardous Waste issues.

LOW LEVEL RADIOACTIVE WASTE DISPOSAL

As previously stated, California law requires that a LLRW disposal facility be established in California to meet the state's responsibilities under the federal Low Level Radioactive Waste Policy Act for safe disposal of LLRW generated in the state by non-federal activities. California produces approximately 200,000 cubic feet of such LLRW annually. California's LLRW currently is disposed at two of the nation's three LLRW disposal facilities: Richland, Washington and Beatty, Nevada.

In the late 1970's, Washington, Nevada and South Carolina (location of the third disposal facility) made it clear that their states would no longer bear the burden of the nation's LLRW disposal. In response, Congress enacted the Low Level Radioactive Waste Policy Act of 1980. This act gave each state the responsibility for managing its own waste and encouraged the states to form regional compacts.

As the states experienced delays in establishing new disposal sites, Congress passed the LLRW Policy Amendments Act of 1985. This act provides for the three existing facilities to remain open to all states until 1993 providing that the states show progress toward disposal facility development. Congress established specific milestones to demonstrate progress. The ultimate deadline is 1993, at which time the states must have a disposal facility ready to receive the LLRW or have entered into a compact with one or more states that have a facility. To ensure that progress is made, Congress allowed Washington, Nevada and South Carolina to impose significant surcharges on waste disposal at the existing facilities. In 1993, those states can refuse to accept other states' LLRW. In 1993, each state must assume responsibility for all its non-federal LLRW, whether or not it has an established disposal facility.

In December 1982, the Nuclear Regulatory Commission (NRC) issued Title 10 Part 61 of the Code of Federal Regulations. These regulations provide requirements for disposal of LLRW and identify criteria for site selection. 10 CFR 61.50, Disposal Site Suitability Requirements for Land Disposal, identifies the technical basis for the siting criteria developed for the California facility.

In response to federal law, the California Legislature passed AB 1513, Chapter 95 (1982) and SB 342, Chapter 1177 in 1983. Consistent with the California Radiation Control Law, AB 1513 directed the California Department of Health Services (DHS) to develop a plan for the management, treatment and land disposal of LLRW and

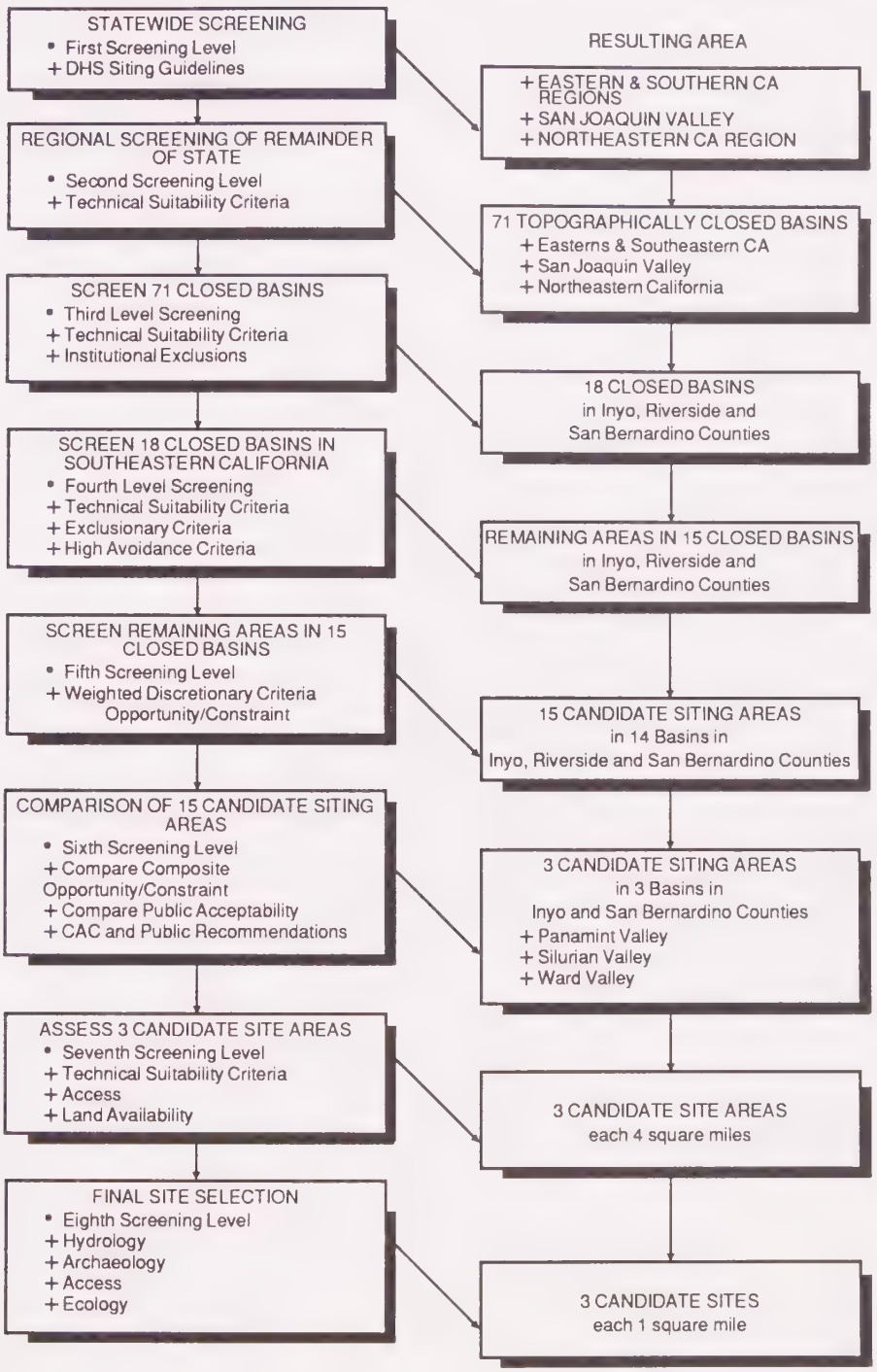
to assume responsibility as the licensing authority for the facility. Among other mandates, AB 1513 required DHS to develop siting criteria with 10 CFR Part 61, which was incorporated into the California Administrative Code under Title 17, Section 30470. In response, DHS recommended criteria which incorporated the federal regulatory requirements, and made additional recommendations reflecting California's specific conditions.

Among other provisions, SB 342 directed the Governor to perform a statewide screening study to identify suitable disposal areas, and to select a "license designee" to establish a site. These responsibilities were assigned to DHS. In response, DHS conducted a statewide screening study. The results were summarized in its 1984 report, Low-Level Waste Area Suitability Study.

Consistent with SB 342, DHS selected US Ecology, Inc., as the license designee to find suitable sites for the facility, characterize them, apply for a license, and upon licensing construct and operate the facility. The Legislature directed that the license designee would carry out these activities under DHS oversight.

US Ecology is following a three phase program leading to development of California's LLRW disposal facility. In Phase 1, US Ecology carried out systematic statewide, regional and local screening studies during 1986-1987. The investigation included the development and application of site selection criteria. Figure 10 depicts the selection procedure. In April 1987, US Ecology identified three candidate sites. The three candidate sites were: 1) Panamint Valley (Inyo County, 29 miles north of Trona/Pioneer Point); 2) Silurian Valley (San Bernardino County, 15 miles north of Baker) and; 3) Ward Valley (San Bernardino County, 25 miles west of Needles). Phase 2, Site Characterization, was US Ecology's program of detailed site studies. These studies were conducted to meet regulatory requirements. Specific technical investigations were carried out over a period of one year to determine the site technically suitable to contain the waste and pose no hazards to public health and safety. These included studies of groundwater, surface water, seismicity, geology, meteorology, biology, mineral resources, population and other environmental features related to implementation of federal and California law. The result was the designation of the Ward Valley site for Phase 3. Currently, in Phase 3, US Ecology has applied for a license for a facility at the Ward Valley site. The complete license application included detailed engineering design, operation plan and safety procedures, closure plan and other information. It contained supportive information and assessment of hazard from radionuclide migration. DHS is reviewing the license application, and conducting independent environmental assessments in accordance with the California Environmental Quality Act. It will hold public hearings on the environmental impact report and the license application, and approve specific facility design and operational requirements. Therefore, licensing is not yet a foregone conclusion at the Ward Valley site. The environmental impact report, public hearings and licensing application process, involving specific site design and mitigation measures are in process.

Figure 10



Site Selection Criteria Application Procedure

The chosen site will dispose of approximately eight million cubic feet of high-tech trash, such as hospital vials, syringes and gloves contaminated with low-level radiation from California and possibly, under special agreement from Arizona, North and South Dakota. The specific method of disposal will be determined as part of the environmental review and licensing procedures. The facility will be open for 30 years and the state will maintain it for 100 years when it will cease to be radioactive.

REFERENCES

Fuller, Alison, Disposing of Low-Level Radioactive Waste in California, League of Women Voters Southern California Regional Task Force, Dec. 1, 1984.

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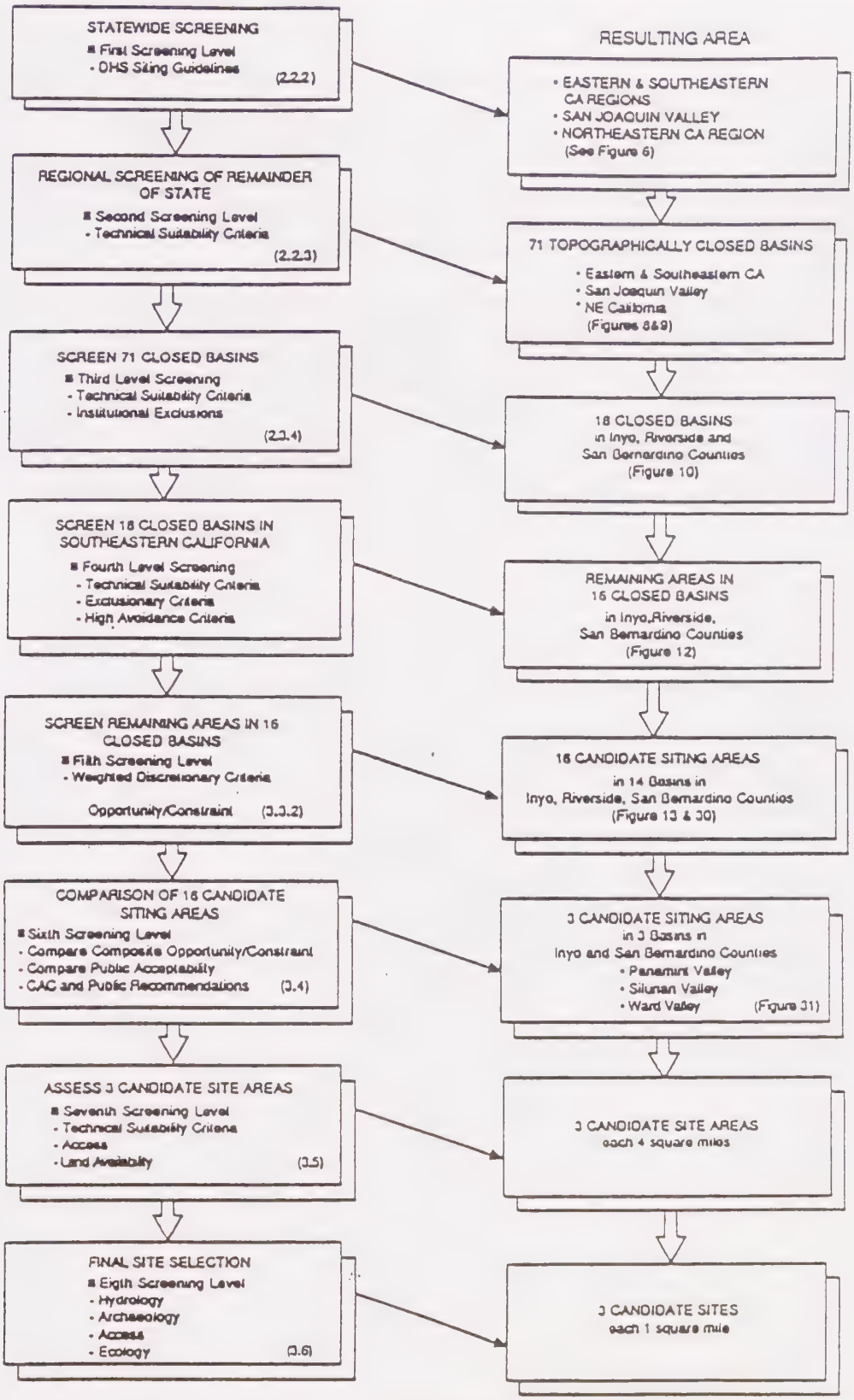
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STATEWIDE SCREENING
■ First Screening Level
- DHS Siting Guidelines
(2.2.2)
RESULTING AREA
• EASTERN & SOUTHEASTERN CA REGIONS
• SAN JOAQUIN VALLEY
• NORTHEASTERN CA REGION
(See Figure 6)
REGIONAL SCREENING OF REMAINDER OF STATE
■ Second Screening Level
- Technical Suitability Criteria
(2.2.3)
71 TOPOGRAPHICALLY CLOSED BASINS
• Eastern & Southeastern CA
• San Joaquin Valley
• NE California
(Figures 8&9)
SCREEN 71 CLOSED BASINS
■ Third Level Screening
- Technical Suitability Criteria
- Institutional Exclusions
(2.2.4)
18 CLOSED BASINS
in Inyo, Riverside and San Bernardino Counties
(Figure 10)
SCREEN 18 CLOSED BASINS IN SOUTHEASTERN CALIFORNIA
■ Fourth Level Screening
- Technical Suitability Criteria
- Exclusionary Criteria
- High Avoidance Criteria
REMAINING AREAS IN 16 CLOSED BASINS
in Inyo,Riverside, San Bernardino Counties
(Figure 12)
SCREEN REMAINING AREAS IN 16 CLOSED BASINS
■ Fifth Screening Level
- Weighted Discretionary Criteria
Opportunity/Constraint (3.3.2)
16 CANDIDATE SITING AREAS
in 14 Basins in Inyo, Riverside, San Bernardino Counties
(Figure 13 & 30)
COMPARISON OF 16 CANDIDATE SITING AREAS
■ Sixth Screening Level
- Compare Composite Opportunity/Constraint
- Compare Public Acceptability
- CAC and Public Recommendations (3.4)
3 CANDIDATE SITING AREAS
in 3 Basins in Inyo and San Bernardino Counties
• Panamint Valley
• Silurian Valley
• Ward Valley (Figure 31)
ASSESS 3 CANDIDATE SITE AREAS
■ Seventh Screening Level
- Technical Suitability Criteria
- Access
- Land Availability (3.5)
3 CANDIDATE SITE AREAS
each 4 square miles
FINAL SITE SELECTION
■ Eigth Screening Level
- Hydrology
- Archaeology
- Access
- Ecology (3.6)
3 CANDIDATE SITES
each 1 square mile

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References

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SECTION II

NATURAL RESOURCES

BIOLOGICAL

BIOLOGICAL RESOURCES

I. INTRODUCTION

San Bernardino County, the largest county in the nation, is situated within the most biologically diverse state in the nation. Elevations within the county vary from sea level in the desert to 11,502 ft at the peak of Mt. San Gorgonio. Annual precipitation varies from only a few inches in the desert to more than 50 inches within the higher mountain regions, and temperatures range from summer extremes of 120 F in the desert to extreme winter temperatures of -25 F in the mountains. These environmental influences and other abiotic factors have changed and shaped the biological resources of the region. Thorne (1976) lists approximately 59 vegetation communities in southern California alone, and many of these, exclusive of those dependent on the coast, can be found within San Bernardino County. Each vegetative community supports a unique complex of faunal species.

Biological resources are generally recognized as important, but management of these resources is too often a secondary consideration. Undeveloped tracts of land, managed or native, increase the quality of life within a region by providing recreational area, visual amenities, educational and research opportunities, and habitat for wildlife. Because of the natural world's complexity, the long-range effects of development on plant and animal species are difficult to predict, evoking the concern of biologists, environmentalists, and resource and regulatory agencies. Species increase or decrease, endure regional extinctions, or die out completely without human intervention. However, urban expansion, and particularly unmanaged sprawl, accelerates these processes immensely. The true sensitivity of a species or a biological resource and the significance of potential impacts to these resources are not always well-defined. The interdependence of a species and its habitat is complex; for some "sensitive" species, upsetting the balance of this interrelationship can result in the extinction of the species and its habitat as well as disruption of the functioning of a complete ecosystem. The California Environmental Quality Act (CEQA), together with the state and federal Endangered Species Acts, provide the legal definition and basis for these determinations within the State of California, and guidelines for environmental impact assessment have been developed (Nelson 1981, on file in Office of Planning).

The existing literature on San Bernardino County's diverse biota is often presented as locally specific reports, sometimes difficult or impossible to obtain. In addition, large areas of the county remain biologically unexplored. The background report presents an overview, not a detailed enumeration, of San Bernardino County's biological resources. After the general setting (based on major biological communities) is established, only sensitive

resources are then given further emphasis. Sensitive species within the county are evaluated within a regional context to identify distributions and areas that may serve as critical habitat, indicate significant populations, and/or support state and federally listed rare, endangered, and threatened biota. The focus is on species not currently protected by preservation or management policies as well as species listed by the state and federal governments. Near- and long-term preservation needs are identified and include the relationship between the resource and its occurrence on county land. Emphasis is on preserving those resources that the county may best be able to manage and preserve. Compilation of such information can serve several purposes for the county government: consolidation of existing data can help identify where further information is needed, suggest conservation areas with the greatest potential for long-term management, and identify constraints and opportunities for development. Sensitive species and habitats within the county have been located on 1:250,000 scale USGS topographic maps which are on file at the San Bernardino County Office of Planning.

II. CURRENT STATUS/ANALYSIS

A. Sources of Data and Methods of Analysis

The biological resources of San Bernardino County were studied using aerial photography, 1988 California Natural Diversity Data Base (CNDDB) listings, and numerous biological reports prepared for or around the area, including existing Environmental Impact Reports (EIRs), community plan reports, and the county General Plan Update. The U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG) afford legal protection to rare, threatened, and endangered plants and animals in California. The USFWS and CDFG also recognize certain habitats as sensitive, as do local governments. Sensitive floral and faunal species that have been observed in the study area are listed in the Background Report (on file in the Office of Planning). In addition to these official listings, other organizations and documents identify sensitive plants, animals, and habitats and existing or recommended policies for their preservation:

- California Native Plant Society (CNPS, Smith and Berg 1988)
- Audubon Society Blue List (Tate and Tate 1982)
- Bird Species of Special Concern in California (Remsen 1978)
- An Annotated Check List of the Amphibians and Reptiles of California (1983)

- Preliminary Descriptions of the Terrestrial Natural Communities of California (Holland 1986)

- The California Desert Conservation Area Plan (BLM 1980)

- San Bernardino National Forest Land and Resource Management Plan (USDA 1988)

A general description of the overall biological resources within the county was generated. Because of the magnitude of the county and its generally undeveloped state, however, data are not available for the entire region and gaps persist in the database. No fieldwork was conducted for this study.

A number of sensitive plant and animal species, and their habitats, occur within San Bernardino County. Sensitive biological features are herein considered floral or faunal species of rare and/or endangered status, depleted or declining species, and species and habitat types of unique or limited distribution. Sensitive habitats are those which are considered rare or valuable within the region, support sensitive plants or animals, support large numbers of individuals, unique associations, or exhibit particularly high diversity.

Within San Bernardino County there are numerous federal, state, and local agencies responsible for managing open space conservation areas. For instance, the BLM has designated areas within the Mojave Desert as Areas of Critical Environmental Concern (ACEC). An ACEC is defined by the BLM as an area within the public lands where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards. By designating areas as ACECs, the BLM can develop special management programs for specific resources. Management programs are developed for each area proposed for ACEC prior to designation. The management programs are site-specific and include actions that give authority to the BLM to implement such actions as patrolling, fencing, signage, and recommendations for further actions which BLM does not have direct authority to implement.

The CDFG also recognizes Areas of Special Biological Importance (ASBI). These are areas of special importance for one or more kinds of wildlife, thus considered to be particularly sensitive to development by the department. The ASBIs are meant to alert planners to the resources within them so that potential adverse impacts from land use can be identified and then either reduced or avoided. These include:

- U.S. Forest Service--Cucamonga Wilderness, San Gorgonio Wilderness, and Sheep Mountain Wilderness

- Bureau of Land Management--The BLM's Areas of Critical Environmental Concern include: Grimshaw Lake, Amargosa River, Salt Creek, Clark Mountain, New York Mountain, Ft. Piute, Fort Soda Mojave Chub, Afton Canyon, Eriophyllum Preserve, Harper Dry Lake, Mojave Fishhook Cactus Preserve, Upper Johnson Valley, Soggy Dry Lake, and Big Morongo Canyon.

- California Department of Fish and Game--Camp Cady Wildlife Area, King Clone Creosote Ring, and Baldwin Lake Ecological Preserve.

- Nature Conservancy--Baldwin Lake Preserve, Big Morongo Canyon Preserve, Castle Glen Bald Eagle Sanctuary, and Sugarloaf Biota Bank.

- University of California (Natural Reserve System)--Day Canyon, Burns Pinyon Ridge, Granite Mountains, and Sacramento Mountains.

- State of California--Chino Hills State Park, Providence Mountain State Park, Silverwood Lake State Recreation Area, and Mojave River Forks Recreation Area.

- San Bernardino County--Prado Regional Park, Cucamonga Guasti Regional Park, Glen Helen Regional Park, Yucaipa Regional Park, Mojave Narrows Regional Park, Park Moabi, and Lake Gregory.

In addition to the areas listed above that are protected by particular agencies, there are other areas of the county that are also of biological importance. These include alkali wet meadows, pebble plains, limestone substrate, walnut woodland, Joshua tree woodland, perennial springs and riparian woodlands. These areas are important biologically as they support flora or fauna that are limited in their distribution, or require or tolerate unusual conditions that occur there. These areas are discussed in the sections below for the valley, mountain, and desert regions of the county.

B. Existing Conditions and Trends

Valley Region

The valley region of San Bernardino County is approximately 50 miles long from east to west and encompasses 480 square miles. This region is almost entirely urbanized with few natural open space areas still existing. The predominant vegetation types within the undeveloped areas of the valley are chaparral, coastal

sage scrub, deciduous woodlands, grasslands, and wetlands. Vegetation in urbanized areas consists primarily of introduced landscape species.

1. Chaparral

Chaparral is widely distributed throughout California on dry slopes and ridges at low and medium elevations where it occupies thin, rocky, or heavy soils. It consists typically of shrubs with tough, broad leaves, but its species composition varies considerably. Several different chaparral subtypes occur in San Bernardino County. The most common subtypes in the Valley region are southern mixed chaparral, chamise chaparral, and scrub oak chaparral. These associations are located predominantly along the lower slopes of the mountains, in the interface zone between the valley and mountain regions.

There are six sensitive plant species that occur within chaparral habitats in San Bernardino County; of these, only one is state-listed as endangered, Nevin's barberry and one is state-listed as rare, Parish's checkerbloom).

No sensitive animal species of San Bernardino County are directly dependent upon chaparral habitat. However, sensitive faunal species from adjacent coastal sage scrub habitat may utilize chaparral as a corridor or for foraging. These species may include Stephens' kangaroo rat, Los Angeles pocket mouse, and San Diego horned lizard.

2. Coastal Sage Scrub

Coastal sage scrub in the valley region is classified as Riversidean sage scrub, the most xeric expression of coastal sage scrub south of Point Concepcion. This habitat grows on steep slopes with severely drained soils, and dominant species are relatively shallow-rooted shrubs.

Riversidean alluvial sage scrub is a variation of Riversidean sage scrub which also exists in the valley region. This vegetation type is the dominant habitat of the upper Santa Ana River floodplain and also occurs in the Cajon and Lytle washes. Riversidean alluvial sage scrub differs from typical sage scrub in that it supports a number of large woody evergreen shrubs typical of chaparral. This vegetation community is typically dominated by low, half-woody shrubs that are drought deciduous and have a relatively open canopy. Riversidean alluvial sage scrub is considered a rare and endangered habitat type and is declining rapidly regionally.

Riversidean alluvial sage scrub is listed as a rare and endangered habitat, although it has no formal federal or state status. This habitat type supports several sensitive plant and animal species

and therefore is a valuable natural resource. These communities occupy some of the few remaining large areas of undeveloped natural open space in the valley region and, therefore, should be considered for conservation.

3. Deciduous Woodlands

California walnut woodland is restricted to the Chino Hills and Etiwanda area within the Valley region. This woodland occurs among rocky outcrops intergrading with scrub habitat or on more mesic sites intergrading with canyon live oak woodland. California walnut woodland is considered a sensitive habitat due to its small acreage and limited distribution in the county; no sensitive floral species are solely dependent on this woodland habitat for their life cycle, however. CNDDB has acknowledged this habitat as possibly threatened but needs more information to reach a determination. No federal or state sensitivity listing exists for Juglans californica or for any other species associated with California walnut woodland.

Animals associated with California walnut woodland are similar to those species that would utilize oak woodland. These include Anna's hummingbird, acorn woodpecker, Nuttall's woodpecker, deer mouse, California ground squirrel, striped skunk, and coyote. No sensitive animal species as listed by the USFWS or CDFG are dependent on California walnut woodland within the valley region of San Bernardino County.

California walnut woodland is possibly a threatened habitat type; however more information is needed to accurately classify it. Therefore, any development occurring in or near this habitat should be surveyed by a qualified biologist in consultation with the CDFG. California walnut woodland occurring in the Etiwanda region appears to be the eastern extent of this habitat and should be further studied.

4. Grasslands

The disturbed grasslands of the valley region of San Bernardino County are a heterogeneous complex that may be associated with shrubs or trees on land that has been disturbed or altered by development or fire. Nonnative weedy vegetation is common in this habitat and includes slender wild oats, foxtail fescue, ripgutgrass, short-pod mustard, red-stem filaree, and pin-clover. One sensitive plant species may occur in the grassland areas of the northern Valley area of San Bernardino County, Orcutt's brodiaea. This species, which is seriously threatened by development, may be found in valley/foothill grasslands, cismontane woodlands, and vernal pool habitats.

Birds of prey utilize grassland areas for foraging. Locally breeding raptor species include black-shouldered kite, red-tailed

hawk, red-shouldered hawk, great horned owl, and barn owl. Other faunal associates include house mouse, southern grasshopper mouse, and gopher snake. No sensitive animal species are expected to utilize the grassland areas of the valley region of San Bernardino County.

The loss of disturbed or nonnative grasslands does not, by itself, pose a biological constraint to development. However, the cumulative loss of open space will reduce raptor foraging areas. It is important that preserved grasslands are large enough to support a sufficient prey base, i.e., small rodent populations.

5. Wetlands

Wetland communities include riparian areas and marshes, where moisture is at or near the surface year-round, including intermittent drainages. In southern California, wetland habitats are declining and are considered sensitive. Wetlands are further subject to state and federal regulations.

A number of stream channels flow through the valley region of San Bernardino County including Cucamonga Creek, Cajon and Lytle Creek washes, Santa Ana River, Oak Glen Creek, and Yucaipa Creek. The presence of water provides a favorable habitat and promotes increased plant growth of a variety of native trees, shrubs, and herbs. Where water is present near the surface in stream channels year-round, a riparian woodland community can be maintained. In stream channels with intermittent surface or ground water availability, a riparian scrub community may develop. Both of these communities exist in the valley region. A well-developed stand of riparian woodland occurs in the Prado Basin of San Bernardino County and extends south into Riverside County. Remnant riparian woodlands also exist in the Santa Ana Wash area.

A freshwater marsh is located north of Etiwanda in the Day Canyon Wash area. Freshwater marsh also occurs in the Prado Basin and may occur in the other drainages of the valley region, wherever moisture is at or near the surface year round. This habitat is usually dominated by perennial, emergent monocots 4-7 ft tall. Monotypic stands of bulrushes or cattails often characterize this habitat.

Wetland habitats in southern California are declining rapidly due to development and flood control projects and, therefore, support a number of sensitive or declining species of local, regional, and national concern. Two potentially occurring sensitive plant species in this habitat are: Santa Ana River woolly star, a state and federally listed endangered species, and Coulter's matilija poppy, a CNPS listed species. Although not documented within San Bernardino County in wetland habitat, these species have been identified near the Prado Basin and could occur within

riparian woodland habitats in the valley region (Santa Ana River woolly star was detected in the county in alluvial sage scrub habitat). Two additional sensitive plant species have been documented in freshwater marsh habitat of the Santa Ana River: marsh sandwort, and Los Angeles sunflower. Marsh sandwort apparently has been extirpated from San Bernardino County, while Los Angeles sunflower may be extinct.

Common animals of wetland communities include red-winged blackbird, song sparrow, black phoebe, Anna's hummingbird, common yellowthroat, raccoon, and California vole. Riparian areas also serve as important habitat for deer and as water sources and movement routes for other wildlife. Wetland habitats are declining rapidly throughout the southern California region; therefore, this habitat type supports numerous sensitive animal species, including least Bell's vireo, a state and federally endangered species; bald eagle, a state and federally endangered species; western yellow-billed cuckoo, a state-listed endangered species; long-eared owl, a species of special concern; and California black rail, a state-listed threatened species. The cuckoo and vireo occur in the dense riparian habitat of the Prado Basin. The black rail, dependent on marshes, was recorded long ago at Chino but is not known to occur currently in San Bernardino County. Canada geese, which are very localized in their distribution, have utilized the area of the Prado Basin within San Bernardino County for foraging, with nearby roosting areas to the south.

Many wetland areas in the county have not been mapped. All projects that have a potential to impact wetlands require a site review by a qualified biologist to assess the quality of the habitat from both a project and regional basis. Mitigation is required for all wetland impacts. Long-range conservation of the Santa Ana River wash and the Prado Basin must begin with the precise identification of the sensitive resources and establishment of a policy regarding dedicated biological open space areas.

6. Recognized Important Biological Areas

The most sensitive vegetation types found within the study area are wetlands, including riparian woodland, riparian scrub, and freshwater marsh. Wetlands are considered a valuable but declining resource both locally and statewide and support a high diversity of wildlife species, many of which are dependent on these habitats for some life function. Therefore, the few wetland areas remaining in the county should be preserved in conservation areas. The best example and most representative riparian woodland in the valley region of the county is that in the Prado Basin.

Other areas are important biologically, because they support flora or fauna that are limited in their distribution, or require or tolerate unusual conditions that occur there. For example,

the alluvial sage scrub habitat in the Santa Ana, Lytle Creek, and Cajon washes has adapted to frequent flooding and therefore supports a unique diversity of plant species. Another sensitive area is the Riversidean alluvial sage scrub found in the foothills of the San Bernardino Mountains. This habitat may support several sensitive species including Stephens' kangaroo rat, San Diego horned lizard, Los Angeles pocket mouse, and California bedstraw. Another important biological area is the Chino Hills, which support a wide variety of habitat types including Riversidean sage scrub, riparian woodland, and California walnut woodland.

Mountain Region

The Mountain region of San Bernardino County lies in the southwestern portion of the county and contains the San Bernardino Mountains and the eastern end of the San Gabriel Mountains, both elements of the Transverse Mountain Range of southern California. The major communities include chaparral, sage scrub, deciduous woodlands, conifer forests, wetlands (including woodlands, scrub, marsh, and meadows), and the relict pavement plains.

1. Chaparral

Within the mountains of San Bernardino County, chaparral dominates most of the coastal faces and desert slopes below 5000 ft elevation and occurs as a less continuous habitat up to the conifer zones. Chaparral varies according to aspect and elevation, yet generally forms dense stands. It is a common habitat throughout California and supports abundant wildlife. According to the CEQA, it is considered a sensitive habitat only where it supports populations of sensitive species. At lower elevations, chamise chaparral occurs along ridges and south-facing slopes where soils are shallower and drier and is characterized by chamise, bigberry manzanita, buckwheat, deerweed, black sage, and white sage. Northern or more mesic areas are characterized by mixed chaparral, which is dominated by wart-stemmed and whitebark ceanothus. Other shrubs include chamise, scrub oak, interior live oak, toyon, and holly-leaved cherry. At the higher elevations, montane ceanothus chaparral occurs adjacent to the conifer zone and is characterized by bush chinquapin, pine manzanita, snow bush, and curl-leaved mountain mahogany. Desert chaparral occurring on desert slopes is dominated by Gregg ceanothus, flannel bush, mountain mahogany, chamise, and turbin oak.

Both Parish's checkerbloom, state-listed as rare, and Laguna Mountain jewelflower, both candidates of the federal list, are known from chaparral in the mountains of San Bernardino County. Parish's checkerbloom has been detected within the western portion of the San Gorgonio Wilderness Area, in the vicinity of Big Bear Lake, and historically sighted west of Barton Flats; lower montane conifer forests intergrade with the chaparral in these areas and also provide habitat for this sensitive plant

species. Laguna Mountain jewelflower has been detected in the Constance Peak/Harrison Mountain area. In addition, three species of sensitive plants included on CNPS list, have been detected in chaparral habitat in the mountains. These include many-stemmed dudleya, known from rocky, open areas south and east of Crestline, Hall's monardella, known from the Birch Mountain area and southwest of Lake Arrowhead, and short-jointed beavertail, known from Wright Mountain east to Cajon Canyon.

The animal species inhabiting montane chaparral are similar to those occurring in the Valley region, though some species, such as the black-chinned sparrow as a summer visitor and the fox sparrow as a winter visitor, are much more numerous at higher elevations. The San Diego horned lizard, occurring also in the valley, has been recorded from several localities scattered throughout the eastern San Gabriel and San Bernardino mountains. The gray vireo is characteristic of arid chaparral and piñon/juniper woodland, usually on desert-facing slopes. Considered a second-priority species of special concern by the CDFG, the Gray vireo has a very local distribution in the San Bernardino Mountains, occurring mainly in the Onyx Summit, Round Valley, and Rose Mine areas near the eastern end of the range.

Chaparral is a common habitat, particularly in the mountains, and does not in itself pose a constraint to development from a biological perspective. Potential impacts to chaparral habitat would be viewed as significant only if sensitive species were present. In particular, appropriate habitat near Big Bear Lake and other likely areas must be surveyed for Parish's checkerbloom prior to any proposed construction. Potential impacts to this species require notification of the CDFG, the option of salvaging, and possibly an extensive mitigation program to offset negative effects.

2. Sage Scrub

Riversidian sage scrub occurs on the lowest coastal slopes of the mountains, being more predominant within the valley region. This habitat is recognized as sensitive as defined by CEQA, and continues to be affected by urban expansion. The dominant species is California sagebrush and co-occurring species include buckwheat, black sage, white sage, and desert encelia. Members of the genus Rhus, typical of sage scrubs west of the county, are generally absent from the San Bernardino Mountains. Blackbush scrub is the desert-facing scrub community, occurring on well-drained slopes and characterized by blackbush, saltbush, sage, and desert mallow. Big sagebrush or Great Basin scrub, a higher elevational desert scrub associated with piñon-juniper woodland, is dominated by Great Basin sagebrush; co-occurring species include rabbit brush, shadscale, ryegrass, and several species of needlegrass. This habitat is an important brush type occurring under coniferous forests in basins and flats in the

interior portions of the mountains, particularly the upper Santa Ana River canyon, Holcomb Valley, and Big Bear basin. Pure stands of Great Basin sage scrub can be found in these areas.

The only sensitive plant species reported from scrub habitat within the mountain region is many-stemmed dudleya. As in chaparral habitat, this species would be expected in the more open, drier, or rocky areas of scrub.

The stands of sagebrush scrub in the San Bernardino Mountains are notable because they support isolated colonies of some species typical of the Great Basin and reaching the limits of their ranges in San Bernardino County; examples are the Vesper sparrow and Brewer's sparrow, both of which nest near Baldwin Lake. No species recognized as sensitive by the CDFG, however, is restricted to sagebrush scrub in the San Bernardino Mountains.

3. Oak Woodlands

Oak woodland at the lower elevations (1000 to 2500 ft) of the mountains is dominated by interior live oak and canyon live oak occurring in canyon bottoms and north-facing slopes. This rather moist oak woodland constitutes the canyon live oak ravine forest known only from the extreme western portion of the mountains and recognized as a sensitive habitat. A closed canopy of canyon live oak occurs in both Barrett Canyon and the North Fork of Barrett Canyon, and in San Antonio Canyon near the Mt. Baldy area, Devil's Canyon, Waterman Canyon, and Oak Glen. California laurel is associated with the canopy of this habitat and understory species include red-berry, sugarbush, and poison oak. Both canyon live oak, and California black oak occur up to approximately 8000 ft elevation. Oak woodlands at higher elevations may contain big-cone spruce, often covering entire slopes and dominating over the canyon live oaks.

Whereas oak woodlands are considered sensitive habitats no sensitive floral species are solely dependent on oak woodland habitat for their life cycle. However, sensitive species occurring in habitats adjacent to oak woodlands may be detected within the ecotone of the oak woodlands and the adjacent habitat.

Oak woodlands are widely recognized as being of high value to wildlife. Some species are specialized for or prefer this habitat, such as the acorn woodpecker, plain titmouse, and Hutton's vireo. Cooper's hawk, considered a species of special concern by the CDFG, has a strong preference for nesting in oak trees where they are available.

Because of the recognized sensitivity of oak woodlands and the inherently long replacement time required, this habitat in itself will pose a constraint to development. Opportunities lie in incorporating existing oak stands into project designs to maintain the value of the habitat.

4. Conifer Forests

Coniferous forests occur from approximately 3000 ft elevation up to timber line (approximately 11,500 ft) in the San Bernardino Mountains. Coniferous forests within the county overlie much of the western mountain area from Wrightwood south to the Cucamonga Wilderness Area, and from Lake Silverwood east to Gold Mountain and south through the San Gorgonio Wilderness Area. These forests provide <u>essential</u> water quality and soil protection functions as well as <u>vital</u> conversion of CO_2 to O_2, and climate modification. The alpine zone is limited to the area between San Bernardino Peak and San Gorgonio Mountain with additional small occurrences along the upper reaches of Sugarloaf and Wright mountains, and Cucamonga Peak.

The lower montane forests are interspersed with chaparral and are characterized by knobcone pine, occurring sporadically as even-aged stands, and Coulter pine, a species typically dispersed in small groves of widely scattered individuals. One extensive area north of Lake Arrowhead is dominated by both Coulter pines and black oaks, a combination that is common in the mountains southwest of San Bernardino County, but is unusual within the county. Also unique within the county on drier sites is the Coulter pine/canyon live oak combination occurring east of Lake Arrowhead, south of Keller Peak, and near Barton Flats. On the coastal side of the San Bernardino Mountains between 4500 and 6500 ft elevation is the westside ponderosa pine forest. This habitat is dominated by ponderosa pine; co-occurring species include Rocky Mountain white fir, Coulter pine, canyon live oak, coffeeberry, and deer brush. Similar, but denser than westside ponderosa pine forest, is Sierran mixed conifer forest occurring on north-facing aspects on moister soils than the former habitat. Additional species found in Sierran mixed conifer forest include bush chinquapin, snow bush, deer brush, and several species of currant. Sensitive floral species within the lower montane conifer forests include the state-listed rare Parish's checkerbloom, on the western end of the San Gorgonio Wilderness Area and in the vicinity of Big Bear Lake, and the following species on the federal list: California bedstraw, Barton Flats horkelia, Laguna Mountain jewelflower, and Hall's macrantha. Additional floral species within this habitat that are recognized as sensitive by the CNPS.

The higher elevations of the mountains are typified by upper montane conifer forests, characterized by widely spaced coniferous trees 40 to 100 ft tall. The dominant species include Jeffery pine (5400 to 9800 feet elevational range), sugar pine (4600 to

9000 ft), ponderosa pine (3800 to 8200 feet), Rocky Mountain white fir (4500 to 10,100 ft), and incense cedar (4000 to 7600 feet). Both the ponderosa and Jeffery pines predominate over south-facing, well-drained slopes or cold basins, whereas sugar pine and Rocky Mountain white fir are prevalent among steep, moister north-facing slopes; incense cedar is typical among disturbed canyon bottoms. Canyon live oak commonly occurs as understory on the steeper south-facing slopes, and black oak is scattered beneath conifers in some of the more mesic portions of the forest. Desert aspects between 4500 and 8000 ft are dominated by one-leaf piñon pine; co-occurring species include western juniper, canyon live oak, and curl-leaved mountain mahogany. This habitat occurs as very dense stands near Little Pine Flat, Baldwin Lake, and Rose Mine. The two subalpine conifer forests are lodgepole pine forest and southern California subalpine forest. Lodgepole pine forest, on north-facing slopes above 8000 feet and on south-facing slopes above 9000 feet, is a dense association of slender, even-aged lodgepole pines. An understory is sparse to lacking, but low shrubs and herbs flourish in forest openings. This habitat may be found at Bluff Lake, on the north face of Butler Peak, on the west faces of San Gorgonio Mountain, and in the northwestern corner of Holcomb Valley. Southern California subalpine forest is dominated by both limber pine and lodgepole pine, with limber pine being most important on exposed high slopes and ridges. This habitat is well-developed on San Gorgonio Mountain.

Sensitive floral species occurring within the higher elevational conifer forests include Peirson's spring beauty, occurring in the Cucamonga Wilderness Area on Telegraph Peak and on Thunder Mountain; and Bear Valley phlox, occurring south of Simmons Trout Lake in Big Bear Valley, south of Big Bear Lake, and near the Sugarloaf, Delamar, and Onyx Mountain areas. In addition, four species found within conifer forests are also associated with the montane meadows and pebble plains habitats as discussed below; these include Baldwin Lake linanthus, San Bernardino Mountains monkeyflower, purple monkeyflower, and San Bernardino Mountains owl clover. Orcutt's brodiaea has been detected near Waterman Canyon, adjacent to a streambed in this area. Sensitive species within the subalpine conifer forests include both San Bernardino rock cress, detected on rocky cliffs and talus slopes in the San Gorgonio Wilderness Area, and Johnston's buckwheat, detected above 9000 feet on the west side of Mount San Antonio and in the Cucamonga Peak area. Many other floral species found within the upper elevational coniferous forests are recognized for their regional significance by the CNPS. Within the summit region of San Gorgonio Mountain and its surrounding ridges (above 11,000 ft), and less so on Mount San Antonio, is the very sparsely vegetated southern California fell-field habitat. These summit regions, at and above timberline, are subject to severe winds and provide a rather dry habitat dominated by xerophytic cushion plants. Characteristic species include southern mountain

buckwheat, Parish's alumroot, buttercup, silky raillardella, and small-leaved spiraea. This area of the Mountain region is entirely under the U.S. Forest Service jurisdiction.

Wildlife activity within conifer forests is quite varied, as the forests provide a diversity of habitats that range from nest and perch trees for raptors and other birds, sheltered canyon or cave environments for mammals, dense litter, stumps, and tree hollows for burrows or nests, and ample food sources for all levels of the food chain. The San Bernardino Mountains, being the highest of southern California's ranges, support isolated colonies of many species typical of the Sierra Nevada. Examples are the golden-mantled squirrel, lodgepole chipmunk, northern flying squirrel, hermit thrush, and mountain white-crowned sparrow. The San Bernardino Mountains, especially near their eastern end along Arrastra Creek, are notable as a western outpost for certain birds more common in Arizona, e.g., the whip-poor-will, plumbeous solitary vireo, Virginia's warbler, and hepatic tanager. The last two are considered species of special concern by the CDFG.

The southern rubber boa is associated with the upper conifer forests, where all elevational records are between 5000 and 8000 ft. This species, state-listed as threatened, is normally detected in areas of coniferous forest that have an abundance of forest debris and scattered rocks or rock outcroppings. Occupied or suitable southern rubber boa habitat occurs from Crestline nearly due east to Sugarloaf Mountain. Reported localities also extend as far south as the Keller Peak area, and suitable habitat extends north of Big Bear Lake among the south-facing slopes of Delamar Mountain. Occurring within a similar habitat type as the southern rubber boa is the spotted owl, although the owl is more strickly associated with dense woodlands in steep-sided canyons and shaded ravines characterized by ponderosa, Jeffrey, sugar, and Coulter pines. Although widespread, the spotted owl occurs in low densities (0.5 to 6.0 square miles per pair) and is relatively rare in the San Bernardino Mountains. It is listed as a sensitive species by the U.S. Forest Service and a species of special concern by the CDFG.

The wide diversity of conifer forests in San Bernardino County supports numerous state and federally-listed species. The occurrence of sensitive species within county jurisdiction will pose a constraint to development and should be managed similarly to U.S. Forest Service policies. The Forest Service places a high value on managing resources in their jurisdiction to protect, preserve, and enhance the habitats that contain sensitive resources.

5. Wetlands

Wetland habitats within the mountains include riparian woodlands, riparian scrub, meadows, seeps, marshes, and bogs. In addition,

the several lakes within the mountains provide aquatic and associated lakeshore habitats. These habitats are, of course, limited by availability of water and vary as to whether the source is seasonal, perennial, surface, or perched. Most woodland species are well adapted to severe disturbances resulting from heavy runoff during occasional winter floods. Perhaps the best adapted species is white alder, a widespread tree occurring in washes between 2000 and 7000 ft elevation. Co-occurring species can include western sycamore, Fremont cottonwood, black willow, canyon live oak, and big-leaf maple; understory species include shrubby willows, mugwort, blackberry, and nettle. These species comprise southern sycamore alder riparian forest, considered a sensitive habitat by the CNNDB. One stand of quaking aspen, a regional disjunct, is known from Fish Creek in the San Gorgonio Wilderness Area. In addition, box elder can be found in the Oak Glen area, and mountain maple has been sited on Sugarloaf Mountain near 10,000 feet elevation.

Lower elevational riparian scrub communities are dominated by mulefat and sandbar willow along with red willow and polished willow. Montane riparian scrub is characterized by dense, broadleafed thickets dominated by several willow species, alder, and occasionally dogwood. Dogwood is known from a few watercourses in the vicinity of Lake Arrowhead and Lake Gregory.

Montane meadows occur on fine-textured permanently moist or wet soils above 5000 ft elevation; adjacent habitats occur on coarser, better-drained soils. Characteristic of this habitat is a dense growth of sedges and other perennial herbs including several species of sedge, bulrush, and rush. Alkali wet meadow is restricted in occurrence to Big Bear Valley and the Baldwin Lake area, occurring in areas of vernal meadowlands or along drainages of perennial or spring-fed water courses. More severely water-logged soils having prolonged saturation may support a montane freshwater marsh habitat; the more water-tolerant species Carex and Scirpus are associated with this habitat. Two plant species, both state and federally-listed as endangered, are associated with the montane meadows. These include big-footed checkerbloom and slender-petaled thelypodium known from Big Bear and Holcomb valleys; big-footed checkerbloom is also known from the Arrowhead Lake vicinity. Also occurring within montane meadows is San Bernardino blue grass, San Bernardino butterweed, Baldwin Lake linanthus, Bear Valley haplopappus, San Bernardino Mountains monkeyflower, San Bernardino Mountains owl clover, silver-haired ivesia, and numerous other sensitive floral species. Each of the mountain lakes, Big Bear, Arrowhead, Silverwood, Baldwin, Erwin, Bluff, Gregory, and Green Valley, provide valuable habitat for wildlife and support emergent lakeshore habitat including aquatic vascular plants at their edges. Lakeshore habitat is, of course, confined to the region immediately surrounding each of the lakes.

In the San Bernardino Mountains as in most areas, sensitive wildlife are concentrated in wetlands. Two species designated as threatened by both the state and federal agencies occur in San Bernardino County's mountain wetlands: the bald eagle and the unarmored threespine stickleback. Up to about 30 bald eagles winter regularly at Big Bear and Baldwin lakes from October to April. The eagles feed primarily on fish in the lakes, and the areas where they perch most frequently are Grout Bay, the south shore of Big Bear Lake (particularly Eagle Point), the wooded area between Eagle Point and Interlaken off Condor Drive, and the south and northwest shores of Baldwin Lake. The eagles tend to roost in rather dense stands of mature conifers on east-facing slopes protected from the wind. Bald eagles also occur at Erwin Lake and presumably at Lake Arrowhead and Silverwood Lake as well; they move from lake to lake as a function of the availability of open water. In addition to providing foraging habitat for the bald eagle, the mountain lakes supply principal wintering area for waterfowl migrating along the Pacific Flyway.

The unarmored threespine stickleback, a fish formerly widespread in the Los Angeles Basin, was thought to be restricted to the upper Santa Clara River in 1981, when a previously unknown population was discovered in Baldwin Lake and Shay Creek in the San Bernardino Mountains. Between 1984 and 1986 this population was decimated by drought and water diversion, becoming restricted to two ponds south of Baldwin Lake that are fed by Shay Creek. This fish can be preserved only if a year-round flow is restored to Shay Creek.

In addition to these two already listed as endangered, two additional candidates for listing, both insects (the diving beetle Hydroporus simplex and the butterfly Euchloe hyantis andrewsi), occur in San Bernardino mountain wetlands. The butterfly, known as Andrew's or Martin's marble, occurs in the Lake Arrowhead and Big Bear basins, where its larvae feed on the mountain tansy mustard and the Laguna Mountains streptanthus. A final wetland-dependent sensitive species is the black swift. This highly specialized bird nests only behind waterfalls, and the only known colony in the San Bernardino Mountains is at Fallsvale in Mill Creek Canyon. The black swift is a third-priority species of special concern to the CDFG.

The Big Bear Valley preserve, established by the Nature Conservancy, focused on areas identified by indicator species for mountain meadows and pebble plains (see below). As a result, most of these habitats still available as of 1980 are included in the preserve system. Of the 150 acres of mountain meadows around Big Bear Valley, 24 acres occur within National Forest property, 42 acres are located within the City of Big Bear Lake, and the remaining 84 acres lie within county lands. Long-range conservation of these regionally sensitive habitats must begin with identification of the best remaining representative habitats

and development of a policy regarding dedicated biological open space areas. Meanwhile, site-specific project analyses must stress the regional significance of this habitat. Mitigation may incorporate regional mitigation banking (vs. strict onsite preservation in some cases) to preserve the better remaining habitats.

6. Pebble or Pavement Plains

The pebble or pavement plain habitat within San Bernardino County is unique within California and limited to approximately thirty plains in the area around Big Bear Lake and Holcomb Valley. This habitat is recognized as sensitive. The deep clay deposit originating within the Pleistocene lake that once covered Big Bear was subsequently fragmented by the uplift of Big Bear and Holcomb valleys. More recent frost-heave action has pushed cobbles in the scattered clay deposits to the surface, hence the pebble plain habitat. These deposits become very hot and dry during the summer months and are impermeable to water; thus, conifer seedlings are killed before they can become established. The pebble plains, therefore, remain as isolated islands among other alpine vegetation. Several of the sensitive floral species associated with montane meadows are also found within pebble plains habitat including San Bernardino butterweed, San Bernardino Mountains owl clover, Bear Valley haplopappus, silver-haired ivesia, Baldwin Lake linanthus, and San Bernardino Mountains monkeyflower. Additional floral species included on the federal list include Parish's rock cress, Bear Valley sandwort, Bear Valley woollypod, ash-gray Indian paintbrush, southern mountain buckwheat, purple monkeyflower, and Bear Valley phlox.

The animal life of the pebble plains apparently has not been studied, so the plains' importance to wildlife remains unknown. However, due to the small size of pebble plains any wildlife using the habitat may be dependent on the surrounding habitat.

Of the 316 total acres of pebble plains remaining in the Big Bear Valley area, 168 acres occur on National Forest land, 1 acre lies within the City of Big Bear Lake, and 147 acres occur within unincorporated portions of the county. With three jurisdictions governing this fragile habitat the continuance of three plans that may, in some cases, allow a cumulative impact on pebble plains must be avoided. Only consensus among the governing agencies, including long-range planning and agreement on one regional biotic resources map and its constraints, will ensure a future for this and other sensitive habitats in Big Bear Valley.

7. Recognized Important Biological Areas

The CDFG recognizes 14 Areas of Special Biological Importance (ASBI) within the mountain region of the county. Among the ASBIs are identified key areas that support herds of both resident and

seasonally migratory mule deer. These areas satisfy the year-round life requirements of resident deer herds and occur southwest of Luna Mountain, at Cleghorn Mountain, and east of Harrison Mountain. Good deer fawning areas, generally located near wet meadows and riparian thickets, occur from Manzanita Flat to Plunge Creek in the Alder Creek area and near Keller Meadows and the forks of Plunge Creek, east of Harrison Mountain. Deer winter ranges occur north of Barton Flats and summer ranges occur northwest of Delamar Mountain. Nelson bighorn sheep habitat occurs throughout much of the Cucamonga Wilderness area and north of Delamar Mountain; however, the best habitat occurs within the San Gorgonio Mountain area. The CDFG also recognizes principal wintering area for waterfowl migrating along the Pacific Flyway. Within the mountain region, up to 11,000 waterfowl have been observed at Baldwin Lake, 4,000 at Big Bear Lake. The lake areas also provide wintering habitat for the bald eagle, and both Lake Arrowhead and Lake Big Bear are thus recognized by the CDFG as ASBIs.

Also within the mountain region, the Forest Service manages both the Cucamonga Wilderness area (8,580 acres) and the San Gorgonio Wilderness area (56,749 acres); the latter is the largest established wilderness area in southern California and one of the most heavily used within the nation. The Forest Service also recognizes all riparian areas as special habitat areas; designates Research Natural Areas and has recently designated the Holcomb Valley/Baldwin Lake Special Interest Area. The Forest Service manages land with specific goals for Plant Communities and Wildlife Habitats of Special Concern, Sensitive Species (plant and animal), Emphasis Species and Special Interest Species. These species and habitats are listed in the Forest Land and Resource Management Plan, on file at the Office of Planning. Aside from ASBIs, the CDFG has an established ecological preserve at Baldwin Lake that totals 125 acres, and the Nature Conservancy has four preserves in the mountain region -- Baldwin Lake Preserve (450 acres), Castle Glen Bald Eagle Sanctuary (200 acres), the Sugarloaf Biota Bank (10 acres), and the Big Bear Valley Preserve (over 100 acres). In addition to these designated acreages, other areas, also recognized for the value of their resources, occur within the mountains and remain as important areas to be preserved. These include alkali wet meadow, pebble plains, limestone substrate, and wetlands. Portions of each of these habitats occur on private lands and are thus subject to urbanization pressures (County of San Bernardino 1988). Other unique assemblages of plant and animal species occur throughout the county and must be assessed for their level of sensitivity and need for a more formal preservation plan.

Desert Region

Encompassing the greatest portion of San Bernardino County, the desert region includes a great diversity of biological resources including many sensitive ones. This diversity can be classified

in various ways that may assist resource management and conservation, but at least ten natural communities may be recognized: white fir woodland, piñon/juniper woodland, sage scrub, Joshua tree woodland, Mojave Desert scrub, saltbush scrub, alkali sink, dunes, and wetlands. These groupings are, of course, somewhat arbitrary. The communities usually grade into each other where they meet, each community varies somewhat from place to place, and each contains within it diversity that allows it to be analyzed further still.

1. White Fir Woodland

In the desert region of San Bernardino County, white fir woodland is restricted to steep north-facing slopes and narrow canyons on Clark Mountain, on Kingston Peak, and in the New York Mountains above about 6000 ft. Rocky Mountain white fir is the dominant tree, but one-leaf piñon pine and Utah juniper also are important, reaching larger sizes than they do at lower elevations. The community includes many distinctive understory plants, bringing the total documented flora to about 66 species. All three locations of this community are recognized as "unusual plant assemblages" by the Bureau of Land Management. Two sensitive plant species, foresellesia and Jaeger's ivesia occur in this community, being found only on limestone cliffs above 6000 ft on the north face of Clark Mountain.

The tracts of white fir woodland in the Kingston and New York Mountains are either so small as to be insignificant to wildlife or have not been studied sufficiently to determine their significance. But the habitat on Clark Mountain is recognized as being an important outpost for marginal or pioneering birds from Nevada or Arizona and found at few other places in California. Examples are the hepatic tanager, Virginia's warbler, and gray-headed junco, all regarded as third-priority species of special concern by the CDFG.

The white fir woodlands of the Mojave Desert lie largely under the jurisdiction of the BLM and are remote from areas of likely development. Therefore, conflicts between development and conservation interests over this community are unlikely. Nevertheless, as rare, fragile relicts of a cooler, more humid era, the white fir woodland merits preservation in its entirety, as recommended by the BLM California Desert Conservation Area Plan.

2. Piñon/Juniper Woodland

Piñon/juniper woodland is found above about 5,000 ft elevation in all the higher mountains of the eastern Mojave Desert as well as along the southwestern edge of the desert near the base of the San Bernardino Mountains. One-leaf piñons and Utah junipers 10 to 25 ft high are this community's dominant constituents, and there is a varied understory consisting of shrubs, cacti, and

perennial herbs. In the New York Mountains, especially in Caruthers and Keystone canyons, piñon/juniper woodland is enriched by the addition of oaks and shrubs characteristic of chaparral. This area has been designated an "unusual plant assemblage" by the BLM, as have been areas in the Providence Mountains and on Clark Mountain characterized by limestone outcrops and supporting plants restricted to that soil type. Some 38 species of recognized sensitive plants occur in the habitat, including Thorne's buckwheat, a shrub found only in Fourth of July Canyon of the New York Mountains, and Kingston Mountain cinquefoil, an herb found only above 5200 feet elevation in the Kingston Range. The former is designated endangered by the CDFG. The stand of sword-leafed shrub in the Kingston Range has also been recognized as an "unusual plant assemblage" by the BLM.

Many animals frequent piñon/juniper woodland, but few of them are recognized as sensitive species. Among these are the crissal thrasher, considered a third-priority species of special concern by the CDFG and represented by an unusual highland population in the mountains of the eastern Mojave Desert. The Kingston Mountain chipmunk, restricted to its namesake, is listed among sensitive species. The gray vireo, considered a second priority species of special concern, occurs in very small numbers on Clark Mountain, in the New York Mountains, and in the Mid Hills and at least formerly near Phelan near the base of the San Bernardino Mountains.

Piñon/juniper woodland in the mountains of the eastern Mojave Desert lies away from immediate development pressures. Mining and grazing constitute the principal threats to this habitat and should be regulated, although the primary responsibility for this lies with the BLM. Along the north edge of the San Bernardino Mountains, where future development is likely, environmental impact studies should include searches for the gray vireo at the appropriate season (April-June). Planning for this area should allow for substantial tracts of undisturbed woodland, as the habitat occurs as a narrow strip and could be broken into biologically inviable fragments by piecemeal development.

3. Sage Scrub

Sage scrub occurs between 4500 and 7000 ft elevation and is best developed in the mountains of the eastern Mojave Desert, especially in the Kingston Range and in Pinto and Gold valleys of the Mid Hills. The community is characterized by Great Basin sagebrush, bitterbrush, and rabbitbrush. Often juniper trees are scattered among the sagebrush. Seven species of sensitive herbs occur in sage scrub, including the perennial species, Cima milk vetch, in California known only from San Bernardino County, and naked-stemmed daisy, occurring in the county only in gypsum soil on Clark Mountain. None of the seven is designated as threatened or endangered by the state or federal governments, however. The BLM, recognizing the scarcity of sagebrush scrub so far south,

has designated the occurrence of the community in the Mid Hills as an "unusual plant assemblage."

The animal life of sage scrub is not particularly diverse and includes few sensitive species. The American badger species of special concern by the CDFG, occurs here as well as in other habitats, and the golden eagle and prairie falcon, also specie of special concern, presumably forage in sagebrush.

Because of the remoteness of the sage scrub of the East Mojave Desert from areas of extensive development, little conflict over it is likely. Overgrazing and off-highway vehicle use are the most likely threats. The BLM's guidelines for the land use of areas under its jurisdiction should be sufficient to conserve this community.

4. Joshua Tree Woodland

Joshua tree woodland is widespread in the desert region of San Bernardino County, occurring mainly in the southwestern and northeastern quadrants and between the elevations of 3500 and 4500 ft. Joshua tree is by far the tallest if not the most numerous plant species of the community; the wide spaces between Joshua trees are occupied by a diverse assemblage of shrubs, cacti, and grasses. A long history of overgrazing has favored the shrubs and cacti at the expense of the grasses. In less disturbed areas, such as Lanfair Valley, the community takes on the aspect of a desert grassland, with many showy annual wildflowers in wetter years. Joshua trees form their densest woodland around Cima and reach unusual size in Pipes Canyon. As a result, the BLM has designated the Cima, Lanfair Valley, and Pipes Canyon regions "unusual plant assemblages." Twenty species of plants recognized by the CNPS as sensitive occur in Joshua tree woodland. Probably the two most vulnerable of these are Lane Mountain milk vetch, confined to a small area between the Calico Mountains and Fort Irwin and threatened by grazing, off-highway vehicles, and Army maneuvers and Little San Bernardino Mountains gilia, occurring in San Bernardino County only near the community of Joshua Tree and threatened by development.

Joshua tree woodland supports a wide variety of animals. Three that are recognized as sensitive by the CDFG occur in San Bernardino County primarily in this habitat. Designated as threatened by the state, the Swainson's hawk may still nest sporadically in the Lanfair Valley, though it apparently abandoned the Cima area. The gilded flicker, a specie of special concern, has been reduced in California to one or two pairs near Cima. Bendire's thrasher is a third-priority species of special concern that in California breeds only in San Bernardino County, being

known from the Cima, Lanfair, and Yucca Valley areas. At least formerly it occurred along the southwest margin of the Mojave Desert west to Victorville. These shy birds do not adapt to human disturbance of their habitat.

Conflict between development and conservation of Joshua tree woodland is unlikely in the eastern Mojave Desert but likely for the southwest, especially in the areas from Victorville to Lucerne Valley and from Yucca Valley to Twentynine Palms. Although the occurrence of sensitive species probably will pose a constraint to development of only a small fraction of San Bernardino County's Joshua tree woodland, the uniqueness of this habitat suggests that substantial, biologically viable tracts of it should be preserved wherever possible. For viability, the community requires its natural ground cover as well as the Joshua trees themselves. Because of the ground cover's fragility, it needs protection from excess human disturbance, such as off-highway vehicles. Development can be best accommodated in areas of Joshua tree woodland if it is grouped in specified areas, leaving areas of at least several hundred acres in designated open space. By these means, native plants and animals are more likely to remain in their habitat than if developments were scattered among the Joshua trees, which would create an urban environment superficially adorned with some native desert vegetation.

5. Mojave Desert Scrub

The greatest proportion of San Bernardino County's deserts is covered with various types of Mojave Desert scrub. The most widespread type is creosote bush scrub. Creosote bush is ubiquitous on slopes and in well-drained flats below about 4500 ft elevation. Other shrubs growing commonly with creosote bush are burrobush, boxthorn, and several cacti. At higher elevations up to 6000 ft blackbush dominates on shallow calcareous soils; on rocky noncalcareous slopes no single species dominates but a diverse scrub occurs, including a wide variety of cacti, agaves, yuccas, Ephedra, other low shrubs, perennial and annual herbs, and grasses. Limestone and gypsum outcrops support plants specialized for or tolerant of those soil types. Because of the wide variety of microenvironments found within Mojave Desert scrub, many localized or scarce and therefore sensitive plants have evolved there. At least 39 species listed by the CNPS occur in Mojave Desert scrub. Of these, the USFWS has sufficient data to support the listing of one as threatened or endangered: Cushenberry buckwheat, found only in and at the base of the San Bernardino Mountains on limestone soils and threatened by off-highway vehicles and limestone mining. Off-highway vehicles, mining and development constitute the primary threats to most desert plants, but some of the cacti, such as foxtail cactus, barrel cactus, and Mojave fishhook cactus are threatened by collecting for horticulture.

A unique attribute of the creosote bush is its tendency to reproduce vegetatively, generating genetically identically individuals in roughly the pattern of a ring, which may persist for thousands of years. Ancient creosote bush rings occurring in the Lucerne and Johnson Valley region have been recognized as an "unusual plant assemblage". The BLM is currently preparing a management and protection plan for creosote bush rings in the Mojave Desert. This plan will provide guidelines to determine when rings should be considered sensitive, since ring formation itself is a relatively common occurrence. Key factors for a sensitivity determination will likely include size (i.e., age) and/or density of rings in an area, and the susceptibility of the formations to erosion.

Other unusual plant features recognized and mapped by the BLM in Mojave Desert scrub are stands of the rare crucifixion thorn in the Cronese, Ward, and Chemehuevi valleys; the stands of jojoba in the Ord Mountains; ocotillo on Homer Mountain; smoketree in the Piute Valley; succulent scrub and huge Mojave yuccas in the Woods and Hackberry mountains; ancient Mojave yucca clones in the Fry Mountains; teddy bear cholla in the Sacramento and Stepladder mountains; and saguaro cactus in the Whipple Mountains.

The wildlife of Mojave Desert scrub occurs at low densities but is fairly diverse and highly specialized for the arid environment. It includes several rare, unusual, or protected species, perhaps the best known of which is the desert tortoise. Occurring in Joshua tree woodland as well as creosote bush scrub, the desert tortoise is fully protected by California law (under CEQA), and the USFWS has been petitioned to add the tortoise to its list of endangered species. Desert tortoises require flat open sandy areas or washes, habitat highly vulnerable to degradation by off-highway vehicles. Desert tortoises occur throughout much of San Bernardino County's deserts, and areas of their habitat have been mapped by the BLM and the CNDDB. Regions known to be important to the desert tortoise include areas East of Helendale, north of Barstow, the Shadow and Ivanpah valleys, and much of the East Mojave Desert from the Piute Valley and Providence Mountains to the Chemehuevi Valley. Many of these areas are remote from likely developments, but conflicts between development and conservation of tortoise habitat appear likely near Barstow, around Lucerne Valley, and between Yucca Valley and Twentynine Palms. Even in remote areas, however, the desert tortoise is vulnerable to collectors and vandals, despite the CDFG's vigorous education campaign.

Another vulnerable reptile that is a candidate for the USFWS list of endangered species, the gila monster, appears less threatened because it is restricted in California to remote sections of the East Mojave.

Mohave ground squirrel is found only in the western Mojave Desert, in San Bernardino County east to the Lucerne Valley, near Barstow, and the Avawatz Mountains and in adjacent portions of Inyo, Kern, and Los Angeles counties. Designated by the CDFG as threatened, the species is found most widely in creosote bush scrub, though also in Joshua tree woodland, saltbush scrub, shadscale scrub, and blackbush scrub. Off-highway vehicle use, urbanization, and agricultural development are believed to be the threats to the Mohave ground squirrel; agriculture promotes the proliferation of Beechey and round-tailed ground squirrels, which may compete with the Mohave ground squirrel. The Mohave ground squirrel apparently has been eliminated from the area between Victorville and Lucerne Valley, and conflicts between development and conservation of the species appear likely in the Victorville and Barstow areas.

LeConte's thrasher occurs throughout the California deserts but in very low densities (five pairs or less per square mile even in optimum habitat). Found also in saltbush scrub, LeConte's thrasher is perhaps most characteristic of creosote bush scrub with scattered cholla cacti (used for nest placement) but is absent from many tracts of seemingly suitable habitat. This extremely shy bird has probably been reduced substantially by off-highway vehicle disturbances. It is ranked as a third-priority species of special concern by the CDFG but probably needs more protection as one of the desert's most sensitive species.

Although even extensive urban development in the Mojave Desert's potential growth areas would leave vast areas of desert scrub untouched, conservation of this habitat is still a concern. A larger human population places a greater demand on its environment for recreation. When this demand is expressed through off-highway vehicle driving, the activities of a small fraction of the population can degrade a large fraction of the natural environment. To the species that require desert plains, such as the desert tortoise, Mohave ground squirrel, LeConte's thrasher, and certain wildflowers, this degradation is critical. The County of San Bernardino can accommodate this conflict by restricting off-highway vehicle use on lands under its jurisdiction to specified areas and by instituting an education program that encourages its visitors and residents, especially children, to adopt alternative, less destructive pasttimes. San Bernardino County can coordinate with the BLM to restrict access to sensitive areas and limit intensive land uses in these areas.

6. Saltbush Scrub

In flat areas of heavy, poorly drained soil, saltbush scrub replaces creosote bush scrub. Several Atriplex species dominate this habitat, including four-wing and allscale. Other shrubs

typical in this association include hop-sage, cheesebush, and boxthorn. The community is best developed in the region west of Barstow, north of Adelanto, and south of Red Mountain.

Several distinct subtypes of saltbush scrub are recognized, including shadscale scrub and the BLM-designated western Mojave Desert Mojave saltbush assemblage. Shadscale scrub occurs under similar soil conditions but at higher elevations than the other saltbush scrubs, and is dominated by shadscale. This association is more typical of regions farther north, but is represented sparingly in San Bernardino County. An area around Valley Well along Interstate 15 in Shadow Valley has been designated an "unusual plant assemblage" by the BLM. The BLM has identified the western Mojave Desert saltbush assemblage as an "unusual plant assemblage" and given it a special area designation, research natural area, because of its restricted distribution. This association occurs primarily in the vicinity of Kramer Junction, and is dominated by spring saltbush.

The plant life of saltbush scrub is not very diverse, as few plants can adapt to the alkaline soil conditions, but it includes a few specialized species. Six species recognized as sensitive by the CNPS occur in saltbush scrub of San Bernardino County. Among these are the alkali mariposa lily, threatened by grazing and urban development, the Mojave spineflower, threatened by off-highway vehicles and energy development, and the Barstow woolly sunflower, found only in San Bernardino County from the Barstow area west to Edwards Air Force Base and threatened by energy development, highway improvements, and grazing.

Animal occurrence also tend to be sparse in saltbush scrub; for example, a breeding bird census near Cuddeback Dry Lake revealed only two nesting bird species, the sage sparrow and horned lark. No sensitive animal species are restricted to saltbush scrub, but the desert tortoise, prairie falcon, LeConte's thrasher, and Mohave ground squirrel all occur there as well as in other habitats.

Except near Barstow, saltbush scrub does not occur in San Bernardino County in areas of likely urban growth. This habitat is, however, even more susceptible than Mojave Desert scrub to degradation by off-highway vehicle use and other disturbance. As San Bernardino County contains the largest stands of saltbush scrub in California, planning to preserve substantial, biologically viable tracts of it is appropriate.

7. Alkali Sinks

Alkali sinks, dry lake beds, and playas support a vegetation community consisting largely of fleshy salt-tolerant plants such as iodine bush and seepweed, plus saltgrass and saltbushes. The density and variety of plants occurring in this austere environment

are naturally very low, but three recognized sensitive species occur there. These are the Barstow woolly sunflower, discussed above, Parish's phacelia, found at least formerly near Lucerne Valley and Yermo but now possibly extirpated, and the lobed ground cherry, found in California only at a few places in southeastern San Bernardino County.

Two sensitive species of birds, both recognized as second-priority species of special concern by the CDFG, occur in San Bernardino County primarily at alkali sinks: the snowy plover and the short-eared owl. Both of these species nest at Harper Dry Lake, the owl possibly in wet years only. The snowy plover also nests at Searle's Dry Lake, and both birds perhaps at other dry lakes that have not yet been studied. The Yuma clapper rail, a marsh bird on the federal endangered species list, has also occurred once at Harper Dry Lake.

Dry lake beds are unsuitable for urban development but are often the sites of mining and off-highway vehicle activity. These uses can be accommodated with conservation of the alkali sink community if biologically important areas are identified and protected before such activities are expanded. The BLM has designated the parts of Harper Dry Lake under its jurisdiction as an area of critical environmental concern. The Harper Dry Lake ACEC is over 2000 acres in size and includes wildlife and riparian habitat. Management requirements for this area by the BLM include controlled vehicle access, restriction of mineral exploitation, control of exotic species and a complete resource inventory, to name a few. The county's planning for the area should coincide with this to ensure conservation of this unique area. Soda Lake south of Baker also deserves special consideration because of the rare fish associated with it (see below under Wetlands).

8. Sand Dunes

San Bernardino County contains some of America's largest areas of sand dunes. The Kelso Dunes are the highest and best known of these; the Cadiz Dunes are also quite extensive. Both of these have been designated "special attention areas" by the BLM. Smaller areas of dunes are scattered through the desert region from the Dumont Dunes near the Amargosa River in the north to an area on the Riverside County line near Iron Mountain to the south.

Sand dunes support a sparse but highly specialized plant community. Creosote bush is usually the only shrub on sand dunes; most of the plants are grasses (e.g., rigid hilaria, desert panicum, and Indian ricegrass), perennial herbs, and, in wet years, annual wildflowers. The CNPS has not listed any sensitive plant species as occurring in the dunes of San Bernardino County.

Sand dunes are notable for the animals, especially insects and reptiles, that are adapted to live in them. Examples of these

specialized reptiles are the Mojave fringe-toed lizard and the western short-nosed snake. Examples of some insects are the Kelso giant sand treader cricket and the Kelso Jerusalem cricket, both considered candidates for listing as threatened or endangered by the USFWS.

Sand dunes are well-known as a highly fragile habitat subject to long-term habitat degradation by off-highway vehicle use. San Bernardino County's dunes are still rather undisturbed in comparison to those elsewhere in California, and the county should seek to maintain this condition through regulation, education, and cooperation with the BLM.

9. Wetlands

The term "wetlands" encompasses a broad range of habitats. Wetlands found in San Bernardino County's deserts include rivers, marshes, riparian woodland, riparian scrub, palm oases, springs, and seeps. Because several of these diverse habitats often occur together in a restricted area that must be managed, it is useful to discuss them together by region: the Mojave River, the Amargosa River, the Colorado River, and isolated desert oases. Because of the availability of water on or near the surface, wetlands support a more numerous and diverse flora and fauna, including more sensitive species, than any of the desert habitats discussed above.

Because it links the San Bernardino Mountains with the Mojave Desert, the Mojave River supports a unique combination of both coastal and desert plants and animals. It supports probably the most extensive riparian woodland remaining in California's deserts. The surface flow of the Mojave River is highly irregular, with some stretches normally remaining dry even through the winter rainy season. Water generally flows on the surface year round only in the Mojave Narrows, at Camp Cady, and in Afton Canyon. Most of the riverbed consists of open, unvegetated sand. Significant wetland communities, however, occupy four main zones: from Bear Valley Cutoff downstream to Hodge, from west of Harvard Road east about 10 mi (the Camp Cady area), from Afton Canyon to East Cronese Dry Lake, and along the west edge of Soda Dry Lake. The first of these four wetland zones consists of a mosaic of riparian woodland and scrub, with the densest and most extensive woodland in the Mojave Narrows. The woodland consists largely of Fremont cottonwoods, willows, and white alder, while Douglas' baccharis, mulefat, Hooker's evening primrose, scale broom, and prickly poppy are some of the important scrub plants. Although the community as a whole is highly sensitive, none of the component plant species has been recognized as such by the CNPS. The Mojave tarplant formerly occurred in riparian scrub at the

junction of the Mojave River and Deep Creek at the base of the San Bernardino Mountains but is apparently now extinct, not having been seen since 1933 despite recent attempts to rediscover it.

The wash downstream of Afton Canyon is vegetated with desert "willows" growing on sand hummocks. This area and the nearby mesquite thickets around Interstate 15 have been designated an "unusual plant assemblage" by the BLM. At Soda Lake, wetland vegetation is restricted largely to seeps along the western edge. Saltgrass, cressa, yerba mansa, and common reed are common wetland plants there.

The Mojave River is a critical resource to many recognized sensitive animal species. The red-legged frog, western pond turtle, Cooper's Hawk, vermillion flycatcher, yellow-breasted chat, and summer tanager all occur in the Mojave Narrows area. In addition, one endangered fish, the Mojave tui chub and at least four sensitive birds, the yellow-billed cuckoo, long-eared owl, willow flycatcher, and least Bell's vireo, formerly occurred in the area but apparently have been extirpated. The USFWS's recovery plan for the Mojave tui chub includes reestablishing it at Mojave Narrows, and if riparian woodland is allowed to increase in the area, any of the birds might recolonize. The Mojave vole is known only from the bottomlands of the Mojave River from Victorville to Helendale and at Harper Dry Lake. A rare snail, Helmintholypta mohaveana, occurs in the banks of the Mojave River near Victorville and Oro Grande.

Despite the Mojave Narrows area being a critical resource to so many sensitive species and wildlife in general, there is a paucity of published information on its fauna. Not lying within the BLM's jurisdiction, Mojave Narrows received little attention in the research for the BLM's California Desert Conservation Area plan, and none of the fieldwork for the Fish and Wildlife Coordination Act report for the Mojave River Forks Dam project was carried out in the Narrows. Environmental impact reports on projects that may affect the Mojave River from Hesperia to Hodge must be based on extensive original biological inventories, as the current data base for the area inadequately represent many of even the common species.

Little information is available on the biology of the Camp Cady area, despite its being a CDFG Wildlife Area. The vegetation includes marshes of cattails, woodlands of willow and cottonwood, thickets of mesquite, and a ground cover of saltgrass and yerba mansa. The CDFG has restocked the Mojave tui chub in ponds at Camp Cady, and the western pond turtle occurs there naturally. The vermillion flycatcher nested there at least until 1947, but no more recent information is available. An isolated colony of tricolored blackbirds, considered a candidate for the endangered species list by the USFWS, was reported in 1985, far outside the

species previously known range. Additional sensitive species should be expected there.

Afton Canyon lies partly in BLM land and its biology was studied for the California Desert Conservation area plan. The BLM has designated Afton Canyon as an "area of critical environmental concern." Afton Canyon features both ponded and flowing water year round, and supports riparian vegetation similar to that at Camp Cady except that the tamarisk tree, a nonnative species, has proliferated at Afton Canyon. Tamarisk competes with native vegetation of higher wildlife value. The western pond turtle is fairly common there, and three species of sensitive birds have been recorded there (the vermillion flycatcher, Bell's vireo, and summer tanager), though whether any of them nests at Afton Canyon is not known. Habitat degradation by off-highway vehicles has been a serious problem at Afton Canyon.

A spring at Fort Soda on Soda Dry Lake is notable as the only site where the Mojave tui chub survives under natural conditions. The spring and two artificial ponds in which the fish have been stocked are maintained by the Desert Studies Center, but the habitat is vulnerable to lowering of the water table.

The core of the Mojave River's riparian habitat lies within Mojave Narrows Regional Park. The management of the park should give habitat and wildlife values the highest priority possible, and extension of the park farther downstream should be given serious consideration. Currently some sections of the riverbed, even within the park, are being degraded by off-highway vehicles. Riparian habitat conservation and off-highway vehicle use are incompatible.

Because desert wetlands are so scarce and fragile and Mojave Narrows is probably one of San Bernardino County's largest and most important desert wetlands, conservation and restoration of the area should be a high priority. Urban development should be directed to desert uplands rather than river floodplains. A critical concern for further development near the Mojave River is the development's effect on the water table. As most of the flow of the Mojave River is underground, projects that lower the water table could deprive the riparian habitat of the water essential to sustain it. Already the groundwater of the Mojave River basin is being overdrafted.

The Amargosa River supports an isolated riparian community that includes several sensitive species and even endemic species and subspecies. Most of these are known to occur only in the Inyo County section of the river near Tecopa, but two scarce fish, the Amargosa pupfish and the Amargosa speckled dace extend south into San Bernardino County. The sensitive species known from the Tecopa area, including the federally-designated endangered least Bell's vireo and Amargosa vole should be searched for along the

San Bernardino County section of the Amargosa River should any development proposal affect that area.

The wetlands of the Colorado River constitute one of the most profoundly altered of California's environments. Originally, the Colorado River flooded every spring, inducing short-term instability within long-term stability. Tracts of riparian woodland, scrub, and marshes would be flooded out in places only to regrow in others. Water flowing year-round provided an environment suitable for native fish and amphibians. The woodlands of willow, cottonwood, and mesquite were extensive enough to support even large predators such as the Yuma mountain lion and the Mexican jaguar. When the river was dammed, the cycle of flooding was broken, introducing short-term stability but long-term instability. Control of flooding allowed former wetland habitat to be turned to agriculture. Nonnative species of plants and animals adapted to the new conditions proliferated, replacing the native species. The native habitat was reduced to small patches insufficient to support most of the larger and many of the smaller species of wildlife. The ecology and prospects for restoration of the Colorado River environment have been studied for several years by Bertin W. Anderson and Robert D. Ohmart of Arizona State University, who have written many reports and journal articles.

The native vegetation communities of the Colorado River consist principally of marshes dominated by cattails, riparian woodland dominated by Fremont cottonwoods and black willows, mesquite woodland, and arrowweed, a riparian scrub. Tamarisk has become the most numerous or even only woody plant in many of the places formerly occupied by native vegetation.

The wetland habitats of the Colorado River were mapped in detail by Anderson and Ohmart. The floods of the early 1980s wiped out much of the riparian vegetation and were followed by proliferation of tamarisk, so an evaluation of the habitat at any site along the river must be based on new information.

A large fraction of the wildlife occurring along the Colorado River is recognized as sensitive by the USFWS and/or the CDFG. In addition to many species having become rare because of habitat loss, many subtropical animals reach the western limits of their range along the Colorado River, which therefore represents the only place in California where they can be found, heightening their statewide sensitivity.

Three fishes native to the Colorado River are recognized as rare: the Colorado squawfish, believed extirpated from California and designated endangered by both the USFWS and CDFG, the bonytail chub, possibly persisting in Lake Havasu and designated endangered by both the USFWS and CDFG, and the razorback or humpback sucker, persisting in Lake Havasu at least until 1979 and designated

endangered by the CDFG. Restoration of these fishes to their natural range, if possible, will require artificial propagation and habitat modification. The USFWS has instituted a Colorado River Fishes Recovery Team to investigate this. The County of San Bernardino should therefore coordinate proposals for aquatic developments along the river with the USFWS.

Among terrestrial vertebrates, one amphibian (Colorado River toad), four mammals, and eighteen birds known from the Colorado River wetlands are recognized as sensitive by the USFWS and/or the CDFG. Some, such as the willow flycatcher, the gilded flicker, Sonoran yellow warbler, and Yuma mountain lion, have probably been extirpated already. The species given the highest priority by the government agencies are the yellow-billed cuckoo, designated endangered by the CDFG, the Yuma clapper rail, designated endangered by the USFWS, and the elf owl, designated endangered by the CDFG. Each of the sensitive species has its own unique combination of habitat needs, from marshes for the Yuma clapper rail and Colorado River cotton rat to extensive willow/cottonwood woodland for the yellow-billed cuckoo and summer tanager and old hollow trees for the bat Myotis lucifugus occultus. A wide diversity of habitats is therefore necessary to support a representation of the Colorado River's native wildlife. The areas of greatest concentration of sensitive wildlife extend from the Nevada line through Topock Marsh and from the Earp/Parker area to the Riverside County line. The shores of Lake Havasu have fewer sensitive species, but pockets of sensitive habitats are scattered along the river the length of San Bernardino County.

The concentrations of sensitive biological resources near Needles and Earp may pose a constraint to development and urban expansion near those communities. The County of San Bernardino has the opportunity, however, to incorporate restoration of natural habitats in its planning for those areas. Anderson and Ohmart have developed techniques for reforestation, so the County can draw on the expertise at Arizona State University. It is likely that further development in the Colorado River Valley can be accommodated without further degradation of the environment if it is directed toward areas already disturbed and combined with riparian habitat restoration.

In addition to the wetlands associated with the three rivers, San Bernardino County's deserts contain many wetlands associated with isolated oases. Two of the largest of these, Big Morongo Canyon and Fort Piute, have been designated as areas of critical environmental concern by the BLM. The California fan palm reaches the northern limit of its distribution in San Bernardino County, and palm oases are recognized as sensitive environments throughout the state. The biological resources of most of the isolated oases, however, have not been identified. Many of them are undoubtedly crucial to the survival of the bighorn sheep, which ranges over many of San Bernardino County's desert ranges.

The distribution and dispersal routes of the bighorn have been mapped by the BLM in its California Desert Conservation area plan and by the CNDDB. The long-eared owl, a species of special concern to the CDFG, is seen most frequently at isolated oases. Probably many of the desert springs are essential water sources for many animals characteristic of upland habitat.

All oases should be considered as sensitive habitats. Pumping of groundwater that would deplete them should be avoided. Access of bighorn sheep to springs should not be disrupted; these shy animals need extensive wilderness areas. Installation of a campground at a critical spring, for example, might eliminate the bighorn from an entire mountain range.

A group of animals with specialized habitat requirements are the bats. Five species recognized as species of special concern by the CDFG occur in San Bernardino County. Each species has its unique requirements and tolerances, but many need caves, rock crevices, hollow trees, and/or abandoned mine tunnels for daytime roosting, hibernation, and as nurseries for their young. Many bats are highly sensitive to disturbance, abandoning their roosts if disturbed even infrequently. Known or suspected bat roosts should therefore be considered sensitive resources, especially if the species using them is listed by the CDFG.

10. Recognized Important Biological Areas

The BLM has designated areas of the Mojave Desert as Areas of Critical Environmental Concern (ACEC) and Special Areas. An ACEC is defined by the BLM as an area "...within the public lands where special management attention is required (when such areas are developed or where no development is required) or used to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards." By designating areas as ACECs the BLM can develop special management programs for specific resources. The management programs are site-specific and include patrolling, fencing, and signage implemented by the BLM; the programs also recommend actions which BLM does not have direct authority to implement. There are 13 designated biological ACECs in the desert region of San Bernardino County. These include:

- Fort Piute
- New York Mountain
- Clark Mountain
- Amargosa River
- Salt Creek
- Cronese Lake
- Fort Soda
- Upper Johnson Valley
- Soggy Dry Lake

- North Harper Dry Lake
- South Harper Dry Lake
- Afton Canyon
- Big Morongo Canyon

Other areas that possess rare, unique, or unusual qualities of scientific, educational, cultural, or recreational significance may be designated as a Special Area. The goals of the Special Areas are to formally recognize significant natural areas on BLM lands, allow uses within the Special Areas compatible with the protection and enhancement of natural resources, and monitor the quality of the natural resources in relationship to allowed uses. Three Special Areas are designated within the desert region: Kelso Dunes is a designated National Natural Landmark, Granite Mountains is a Research Natural Area, and East Mojave is designated as a National Scenic Area.

The CDFG recognizes numerous Areas of Special Biological Importance (ASBI) within the desert region of San Bernardino County that support various important biological resources. These include but are not limited to areas of deer habitat, bighorn sheep habitat, and desert tortoise habitat. The Nature Conservancy also recognizes areas for protection and has designated the Morongo Valley area as the Big Morongo Canyon Preserve.

CULTURAL/PALEONTOLOGICAL

CULTURAL AND PALEONTOLOGIC RESOURCES

CULTURAL RESOURCES

I. INTRODUCTION

Of the 5,000 or more archaeological sites and approximately 3,500 historic sites and structures located in San Bernardino County, a large proportion occur on private lands under the jurisdiction of the County. An equal or greater number of cultural resources are believed to be present but are yet unidentified. Given the rapid development within San Bernardino County, numerous cultural resource sites will be impacted by development.

A. Definitions

The term "cultural resources" includes both archaeological and historical resources. Archaeological resources, in turn, may be either prehistoric or historic in origin.

Archaeological resources are defined as the physical remains of past human activities and can be either prehistoric or historic in origin. Such resources include artifacts, refuse, and features in both surface and subsurface context, 100 years or more in age, and typically are not standing structures.

- Prehistoric archaeological resources may date from 10,000 years ago to the time of historic contact (ca. A.D. 1770) and include Early Holocene lakeside settlements to Late Holocene spring and intermittent stream campsite occupation. Periods of occupation are generally characterized by artifact assemblages and evidence of special adaptations to specific environmental settings/changes. These periods follow Warren (1984) and include Lake Mojave (8000-5000 B.C.); Pinto Period (5000-2000 B.C.); Gypsum Period (2000 B.C.-A.D. 500); Saratoga Springs Period (A.D. 500-1200) and Protohistoric Period (A.D. 1200-Historic contact). Protohistoric occupants of San Bernardino County include the Gabrielino, Luiseño, Kitanemuk, Cahuilla, Serrano, Vañume, Kawaiisu, Panamint Shoshone, Southern Paiute, Mojave, and Halchidhoma.

  Prehistoric archaeological sites may include the remains of villages and campsites, food processing locations, lithic resource procurement and tool-making locations, and burial and cremation areas. They may also consist of trails, rock art and ground figures (geoglyphs), and isolated artifacts. Prehistoric archaeological resources are the result of cultural activities of the ancestors and predecessors of contemporary Native Americans and in many cases retain

special traditional and sacred significance for those people.

- Historic archaeological resources include refuse deposits such as can and bottle dumps, filled-in privy pits and cisterns, melted adobe walls and foundations, collapsed structures and associated features, and roads and trails. They may be related to mission activities, travel and exploration, early settlement, homestead activities, cattle herding, lumbering, and mining, among other themes. In San Bernardino County, historic archaeological resources date from the earliest Spanish mission activities (ca. 1770) to the beginning of this century (A.D. 1900).

Historic resources include intact structures of any type that are 50 years or more in age. These resources are sometimes called the "built environment" and include houses or other structures, irrigation works and engineering features, among other items.

Known cultural resources are those which have been identified through formal recognition on one or more of the following inventories: National Register of Historic Places, California Archaeological Inventory, California Historic Resources Inventory, California Historical Landmarks, and California Points of Historic Interest.

Importance is determined with respect to criteria outlined in the California Environmental Quality Act Guidelines (Appendix K) or in the Code of Federal Regulations for eligibility for listing in the National Register of Historic Places.

Qualified professionals conduct field surveys and data recovery, and prepare evaluations of importance, mitigation plans, and data recovery reports. Depending on the resource involved, qualified professionals may be archaeologists specializing in prehistoric or historic archaeology, or historians specializing in architectural history, oral history, or history of technology. They normally possess advanced degrees in their fields, have substantial experience in the geographic area involved, and are recognized by their respective discipline as qualified for the studies undertaken.

II. CURRENT STATUS/ANALYSIS

This section includes a background overview of the prehistoric, ethnographic, and historic occupation of San Bernardino County; a list of National Register Properties and state and locally important sites; and a listing of regional studies.

General information was gathered from San Bernardino County Museum Archaeological Information Center (Mr. Lester Ross) and

the County of San Bernardino Land Management Department Office of Planning (Mr. Michael Lerch). This study includes a general review of major studies conducted within the study area for the development of a culture history and site sensitivity. It was not the purpose of this study to review site record forms or to create sensitivity maps with the limited funding and time, but rather to use the available data for a synthesis of the existing conditions.

The existing data base for the County of San Bernardino includes a number of Class I (Literature search), II (Sample survey), and III (Intensive inventory) studies conducted on federal lands. Many of the resources recorded on private lands were recorded as a direct result of development, and as such, many of these resources may no longer exist, other than as a site record form or technical report. It is estimated that nearly 1700 reports are on file at the San Bernardino County Museum with roughly half of these studies conducted on private lands and the remainder on public lands (Lester Ross, personal communication 1988).

A. Sources of Data/Analysis

1. Known Cultural Resources

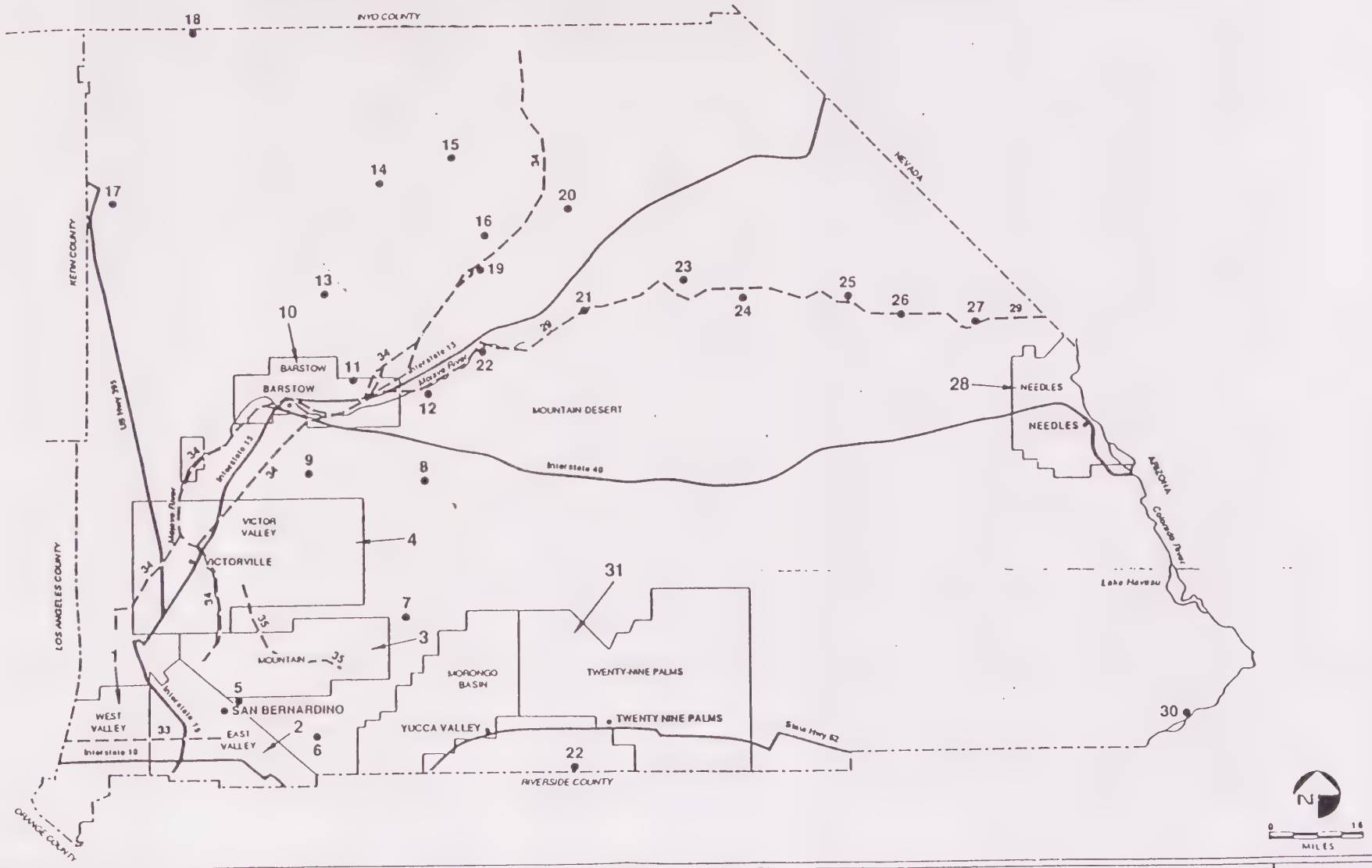
Known cultural resources are those resources that have been placed on the National Register of Historic Places or are California Historical Landmarks, California Historic Resources Inventory sites or listed on the California Archaeological Inventory. A map and listing of all sites by designation is provided as Figure 1 and Key to Figure 1.

2. Existing Policy

In addition to local guidelines, both state and federal laws may be applicable for the protection of cultural resources. CEQA provides that if a "project may cause damage to an important archaeological resource, the project may have a significant effect on the environment" (CEQA, Appendix K, which includes criteria to identify "important" archaeological resources). Should federal funds or federal lands be involved, the National Environmental Policy Act (NEPA) and other federal laws may be applicable.

a. State Guidelines

Guidelines set forth in the California Environmental Quality Act (CEQA) empower public agencies to minimize damage, lessen impacts, and adopt policies supporting CEQA regulations regarding heritage resources.



Listed Cultural Resources within the County of San Bernardino

FIGURE 1

KEY TO FIGURE 1

LISTED PREHISTORIC AND HISTORIC SITES*

Map Location Number	Resource Property Number	Site Name
1	CHL-191	Yorba-Slaughter Adobe
	CHL-360	Tapia Adobe
	CHL-490	Cucamonga Rancho Winery
	CHL-942	Site of the Rancho Chino Adobe of Isaac Williams
	CHPI-SBr-21	San Bernardino-Sonora Road
	CHPI-SBr-32	Battle of Chino
	CHPI-SBr-43	"The Bank Block"
	CHPI-SBr-69	Madonna of the Trail Statue
	CHPI-SBr-70	Sycamore Inn (Uncle Billy's Tavern)
	CHPI-SBr-71	Kaiser Steel
	CHPI-SBr-73	Christmas House
	CHPI-SBr-75	Milliken Ranch, Cucamonga
	CHPI-SBr-76	San Secondo d' Asti Catholic Church
	CHPI-SBr-77	Cucamonga Chinatown Site
	CHPI-SBr-78	Chaffey Communities Cultural Center/Museum
	CHPI-SBr-79	Old Harwood House
	CHPI-SBr-80	Site of Butterfield Stage Chino Station
	CHPI-SBr-81	Dr. Grainger Hyer Home
	CHPI-SBr-82	Garcia Rancho House
	CHPI-SBr-83/ NRHP-L-80-838	S. Fontana Indian Pit and Groove Petroglyph Site
	CHPI-SBr-84	Guasti (Brookside) Winery
	CHPI-SBr-85	Upland Waiting System
	CHPI-SBr-92	Chino Opera House Site
	CHPI-SBr-95	Declez Ranch: Felice Pagluiso Winery/Chapel
	CHPI-SBr-98	Weir Building (North Ontario Surprise)
	NRHP-E-[80-2]	Cucamonga Vicinity Archaeological Site
	NRHP-E-50128	Euclid Ave. Railroad Grade Separation Properties
	NRHP-L-73-428	John Rains House (Rancho Cucamonga)
	NRHP-L-75-460	Yorba-Slaughter Adobe
	NRHP-L-75-522	Moyse Building (Gray Building)
	NRHP-L-78-680	Russian Village District _(Rock Houses)
	NRHP-L-80-839	Frankish Building
	NRHP-L-80-840	Old San Antonio Hospital
	NRHP-L-82-2242	Ontario State Bank Block
2	CHL-42	San Bernardino Asistencia
	CHL-43	Zanja
	CHL-44	Site of Mormon Stockade
	CHL-95	Guachama Rancheria
	CHL-121	Agua Mansa
	CHL-528	Yucaipa Adobe
	CHL-573	Sycamore Grove
	CHL-579	Daley Roll Road Monument

Map Location Number	Resource Property Number	Site Name
2	CHL-617	Fort Benson
	CHL-620	Yucaipa Rancheria
	CPHI-SBr-1	San Bernardino County Museum
	CPHI-SBr-2	Prospect Park
	CPHI-SBr-3	Anson Van Leuven House and Orange Grove
	CPHI-SBr-5	Atwood Adobe
	CPHI-SBr-6	Lugonia School Monument
	CPHI-SBr-7	National Orange Show
	CPHI-SBr-8	The Arrowhead
	CPHI-SBr-12	Baseline Road
	CPHI-SBr-15	Bella Union Hotel Site
	CPHI-SBr-18	Slover Mountain
	CPHI-SBr-19	Mound City
	CPHI-SBr-20	A.K. Smiley Public Library
	CPHI-SBr-21	San Bernardino-Sonora Road
	CPHI-SBr-24	Pioneer Cemetery
	CPHI-SBr-28	Frink Adobe
	CPHI-SBr-31	Cram Ranch and House
	CPHI-SBr-44	Eternity Cemetery of Congregation Emanu El
	CPHI-SBr-52	Cooley Adobe
	CPHI-SBr-53	Santa Fe Station Building
	CPHI-SBr-56	Wells House
	CPHI-SBr-57	Walter C. Nordoff House
	CPHI-SBr-58	Partidge/Donald House
	CPHI-SBr-59	Crafts House
	CPHI-SBr-60	Fred T. Perris House Site
	CPHI-SBr-61	Fisher House
	CPHI-SBr-62	Mormon School Site
	CPHI-SBr-63	Mormon Flour Mill Site
	CPHI-SBr-64	Morey-Cheney House
	CPHI-SBr-67	Confederate Attack Marker Site
	CPHI-SBr-68	A. C. Burrage Mansion
	CPHI-SBr-74	Old Pioneer Catholic Cemetery
	CPHI-SBr-87	San Salvador School Adobe
	CPHI-SBr-88	Home of Neighborly Service
	CPHI-SBr-89	Atchison, Topeka & Santa Fe Railway Station
	CPHI-SBr-90	Andreson Building
	CPHI-SBr-91/ NRHP-L-88-1	City of Colton Public Library
	CPHI-SBr-93	Fontana Farms Company, Camp #1, Ranch House
	CPHI-SBr-94	Fontana Company Tract Office
	CPHI-SBr-96	Fontana Woman's Club House
	CPHI-SBr-97	Fontana Community Church Complex
	CPHI-SBr-99	A.B. Miller Community Park and Plunge
	CPHI-SBr-100	Sturges Auditorium
	CPHI-SBr-101	Sinclair Commercial Block
	CPHI-SBr-102	Heritage House
	CPHI-SBr-103	San Bernardino California Theater

Map Location Number	Resource Property Number	Site Name
2	NRHP-E-78-2368	Marshall House
	NRHP-E-78-2369	White House
	NRHP-E-78-5538	Highland Historical District
	NRHP-E-[86-2]	Greenspot Bridge No. 54C-36B
	NRHP-L-76-513	A.K. Smiley Library
	NRHP-L-77-329	Mill Creek Zanja
	NRHP-L-82-982	Fontana Farms Company Ranch House, Camp #1
	NRHP-L-85-135	Redlands Post Office
	NRHP-L-85-136	San Bernardino Post Office
	NRHP-L-88-1	Carnegie Public Library, Colton
3	CHL-579	Daley Toll Road Monument
	CHL-619	Holcomb Valley
	CHL-725	Old Bear Valley Dam
	CHPI-SBr-11	Rock Camp, Lake Arrowhead
	CHPI-SBr-19	Mound City
	CHPI-SBr-42	Bairdstown
	CHPI-SBr-105	Pinecrest Resort Dining Hall
	CHPI-SBr-109	Saddleback Inn Arrowhead
4	CHL-573	Sycamore Grove
	CHL-963	Mojave Road
	CHPI-SBr-10	Seely Sawmill Monument
	CHPI-SBr-45	Guapiabit
	CHPI-SBr-86	Railroad Summit, Cajon Pass
	NRHP-E-86-3	Victorville Bridge No. 54C-68
	NRHP-L-76-514	Crowder Canyon Archaeological District
5	CHPI-SBr-34	Brookings Sawmill SIte
6	CPHI-SBr-48	Washington Monument
	NRHP-L-75-459	Henry Washington Surveying Marker
7	CHPI-SBr-25	Old Woman Springs
	CHPI-SBr-26	Cottonwood Springs
8	NRHP-L-82-2240	Rodman Mtns Petroglyph Archaeological District
9	CPHI-SBr-30	Willis Well - Stone Monument & Petroglyphs
10	CHS-2311-1/ NRHP-L-75-458	Harvey House Railroad Depot (Casa del Desierto)
	CHS-2311-2	BR 54-211
	CHS-2311-3	BR 54-212Y
	CHPI-SBr-39	Buzzard Rock
	CHPI-SBr-40	Rattlesnake Rock
	CHPI-SBr-41	Alf's Blacksmith Shop
	CHPI-SBr-107	Stone Hotel and People's General Store

Map Location Number	Resource Property Number	Site Name
10	NHRP-E [81-1]	Archaeological Site SBr-189
11	CHL-782	Town of Calico
	CHPI-SBr-54	Borate, Calico Hills
	CHPI-SBr-55	Bismark, Calico Hills
	NRHP-L-73-430	Calico Mountains Archaeological District
12	CPHI-SBr-47	Camp Cady
13	NRHP-E-[80-5]	Goldstone Historical Mining District
14	NRHP-E-[80-4]	Nelson Lake
15	NRHP-E-[80-3]	Drinkwater Spring
	NRHP-E-[81-4]	Archaeological Site SBr-4440
	NRHP-E-[81-5]	Archaeological Site SBr-4441
	NRHP-E-[81-6]	Archaeological Site SBr-4442
	NRHP-E [81-7]	Archaeological Site SBr-4443
	NRHP-E-[81-8]	Archaeological Site SBr-4445
	NRHP-E-[81-9]	Archaeological Site SBr-4444
	NRHP-E-[81-10]	Archaeological Site SBr-4562
	NRHP-E-[81-12]	Archaeological Site SBr-4170
	NRHP-E-[81-13]	Archaeological Site SBr-4213
	NRHP-E-[81-14]	Archaeological Site SBr-4214
	NRHP-E-[81-15	Archaeological Site SBr-4215
	NRHP-E-[82-1]	No Name West Basin Archaeological District
16	NRHP-E-[81-2]	Archaeological Site SBr-112
	NRHP-E-[81-3]	Archaeological Site SBr-4285
	NRHP-E-[82-2]	Archaeological Site SBr-4240
	NRHP-E-[82-3]	Archaeological Site SBr-4241
	NRHP-E-[82-4]	Archaeological Site SBr-4242
	NRHP-E-[82-5]	Archaeological Site SBr-4520
17	NRHP-L-81-169	Squaw Springs Archaeological District
	NRHP-L-82-2241	Steam Well Petroglyph Sites
18	CHL-774	Searles Lake Borax Discovery
19	NRHP-L-82-981	Bitter Spring Archaeological Site
20	NRHP-L-81-170	Archaeological Site CA-SBr-3186
21	CHPI-SBr-33	Mule Car
	CHPI-SBr-49	Soda Spring
22	NRHP-E-80-1	Midway Archaeological Site (CA-SBr-3694)

Map Location Number	Resource Property Number	Site Name
23	NRHP-L-82-2239	Aiken's Wash National Register District
24	CPHI-SBr-13	Marl Springs - Pozos de San Juan de Dios
25	CPHI-SBr-50	Camp Rock Spring
26	CPHI-SBr-29	Lanfair
27	CPHI-SBr-4	Fort Piute
	NRHP-L-73-429	Piute Pass Historic District
28	NRHP-E-86-1	Archaeological Site No. D-6 (CA-SBr-1077)
	NRHP-L-78-745	Topock Maze Archaeological Site (CA-SBr-219)
	NRHP-L-85-3435	Earth Figure D-4 of the California-Arizona Colorado River Basin (CA-SBr-106)
29	CHL-963	Mojave Road
30	NRHP-L-85-3430	Earth Figure E-21 of the California-Arizona Colorado River Basin (SBr-5238)
31	CPHI-SBr-36	Oasis of Mara
	CPHI-SBr-37	Chemehuevi Cemetery
	NRHP-E-78-50132	Twentynine Palms Oasis
32	CPHI-SBr-35	Keys Ranch
	NRHP-L-75-136	
	NRHP-L-75-174	Bill Keys' Ranch
	NRHP-L-75-288	Cow Camp
33	CHPI-SBr-12	Baseline Road
34	CHL-577	Mormon Trail Monument
35	CHPI-SBr-17	Coxey Road

NRHP = National Register Listed Properties
NREP = National Register Eligible Properties
CPHI = California Point of Historical Interest
CHS = California Historic Structures
CHL = California Historical Landmarks

* This list does not include archaeological sites in the California Archaeological Inventory that are not also listed in one of the above registries.

Under CEQA guidelines, Section 21083.2 a : "unique archaeological resource" means an archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

(1) Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.

(2) Has a special and particular quality such as oldest of its type or best available example of its type.

(3) Is directly associated with a scientifically recognized important prehistoric or historic event or person.

Appendix K of the CEQA Guidelines provides that:

an "important archaeological resource" is one which:

A. Is associated with an event or person of:

1. Recognized significance in California or American history or

2. Recognized scientific importance in prehistory

B. Can provide information which is both of demonstrable public interest and useful in addressing scientifically consequential and reasonable archaeological research questions,

C. Has a special or particular quality such as oldest, best example, largest, or last surviving example of its kind,

D. Is at least 100 years old and possesses substantial stratigraphic integrity, or

E. Involves important research questions that historical research has shown can be answered only with archaeological methods.

b. Federal Guidelines

Important documents have been legislated to protect our heritage including the National Historic Preservation Act of 1966, amended in 1976, Executive Order 11593 (1971), Archaeological and Historic Preservation Act of 1974, Federal Property and Administrative Services Act of 1949 (amended 1972), Tax Reform Act of 1976, and Revenue Act of 1978. These last two acts encourage rehabilitation through tax incentives. Further strengthening of these documents

is provided by the California Environmental Quality Act.

Historic resources are physical features, both natural and manmade, associated with human activity. These may include such physical objects and features as archaeological sites and artifacts, structure, groups of buildings, street furniture, signs, mechanical devices, bridges, and planted materials; in short, almost anything that connotes human historic (and prehistoric) presence.

i. National Register Criteria

An assessment of properties for potential inclusion in the National Register of Historic Places requires a determination of site significance through application of National Register criteria: a property must meet one or more of four specific criteria. Significance guidelines are provided with Regulations 36 CFR 63 (Federal Register 1977) or through criteria 36 CFR 60.6 as follows:

> The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of State and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and
>
> (a) That are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> (b) that are associated with the lives of persons significant in our past; or
>
> (c) that embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> (d) that have yielded, or may be likely to yield, information important in prehistory or history.

In addition to meeting one or more of these criteria, a property must also possess integrity. As defined in How to Apply the National Criteria for Evaluation (National Park Service 1982): Integrity is the authenticity of a property's historic or prehistoric period. Integrity applies to historic resources in seven ways: location, design, setting, materials, workmanship, feeling, and association. Just as all criteria do not apply readily to historic sites, properties normally do not possess all

kinds of integrity. Application of kinds of integrity aids in assessing the value of a cultural resources by focusing on the existence and condition of particular features of the property that have a potential to yield important information.

B. Existing Conditions and Trends

San Bernardino County encompasses over 20,000 square miles wherein over 5000 prehistoric and 3500 historic resources have been recorded. Given that only a small portion of the County has been intensively inventoried, these 8500 sites may represent less than 10 percent of the potential of the archaeological and historical record. Site types recorded within the County of San Bernardino include village, temporary camp, rock shelter, milling station, lithic scatter, quarry site, pottery locus, cemetery, cremation locus, intaglio, rock alignment, petroglyph, pictograph, trail, roasting pit, isolate find, cairn, historic, isolate rock ring/cleared circle (USDI BLM 1976).

1. Prehistoric Overview

The prehistoric overview is divided by geologic periods from the Pleistocene to the Holocene. Within the Holocene Period, the culture history follows Warren (1984) and others as discussed below.

Pleistocene (20,000-10,000 B.P. [Before a Present])

Many investigations in the desert areas of San Bernardino County have focused on "early man" and early human occupation dating well into the Pleistocene. Dating of cultural material and clear documentation of human manufacture of these materials have been the major obstacles to addressing the presence of "early man" in the California desert. Early man studies include the work at Calico Hills, China Lake, Manix Lake (Simpson 1958), Coyote Gulch, and Manly Terrace (Budinger 1983; Leakey et al 1970; Simpson 1958, 1961, 1980; E. Davis and Panlaqui 1978; and Clements and Clements 1953). Some of these sites include crude and weathered implements associated with the Malpais industry first defined by M. J. Rogers in the 1930s (Rogers 1939). Terms such as Pre-Projectile Point, Pre-Paleo-Indian, Pre-San Dieguito, and "Early Man" have been used to describe these proposed lithic traditions.

Early Holocene (10,000-7,500 B.P.)

During this period there is clear evidence for human occupation. Populations appear to have been adapted to cooler and moister environmental conditions than the present (Mortland 1974). A resource exploitation pattern for this period, focusing on Post-Pleistocene Lakes, has been described as the Western Pluvial Lakes Tradition (Bedwell 1970; Hester 1973). Populations are characterized as small, mobile groups subsisting through a multiple foraging strategy with either an emphasis on a floral/faunal mixed strategy (Hester 1973) or primary faunal resources (Rogers 1939; Warren 1967; Warren and Ranere 1968). The cultural complex associated with this period has been designated Lake Mojave after a series of sites first identified on the relic Lake Mojave shorelines. The Lake Mojave Complex roughly corresponds to the San Dieguito complex and both may represent regional manifestations of the larger Western Lithic Co-Tradition (Davis et al. 1969). This period is characterized by various large stemmed projectile points (Mojave, Silver Lake, Great Basin Stemmed), leaf-shaped bifaces, crescentics, steep edged unifacial tools along with other flake and core-cobble implements. Milling implements are thought to be rare or absent in Lake Mojave Complex sites (Campbell et al. 1937; Rogers 1939; Wallace 1962; Warren 1967, 1984; Warren and Ranere 1968).

Middle Holocene (7,500-4,000 B.P.)

Following the Lake Mojave Period is the Pinto or the Pinto-Gypsum assemblage of materials identified by Rogers (1939). This assemblage contain weakly shouldered Pinto series dart points, large and small leaf shaped bifaces, domed and keeled unifaces, as well as other flake and core-cobble tool forms (Campbell and Campbell 1935; Rogers 1939; Wallace 1962; Warren 1984). Although there has been some question as to the association of milling tools with this assemblage (Rogers 1939; Wallace 1962), recent work suggests a milling component was a significant part of the assemblage. This period has been tentatively correlated with the Altithermal Period (Antevs 1953) and the possible abandonment of selected areas because of environmental change, but there is some question as to the extent and consistency of environmental change during this period (Moratto et al. 1978). It is probable that resettlement in more suitable resource locales took place as the climate fluctuated. Present site distribution suggests a transient pattern similar to earlier phases and related to the procurement of fluctuating and widely dispersed resources.

Late Holocene (4,000 B.P.-Contact)

Amargosa I/Gypsum (4,000-1,500 B.P.)

Archaeological patterns within this period show a great deal of temporal and regional variation. Assemblages include both the Amargosa and Gypsum complexes. Artifacts include corner notched projectile points including those of the Elko series, as well as Gypsum Cave and Humboldt Concave Base types, along with ground stone, ground slate pendants, flake scrapers and scraper planes (Kowta 1969; Rogers 1939; Warren 1984). During this period a wide range of floral and faunal resources were exploited by regionally specialized gatherers and hunters who used a scheduled cycle across various environmental niches. A decrease in projectile point size toward the end of this period suggests the introduction of the bow and arrow and reduced use of the atlatl.

Amargosa II/Saratoga Springs (1,500-750 B.P.)

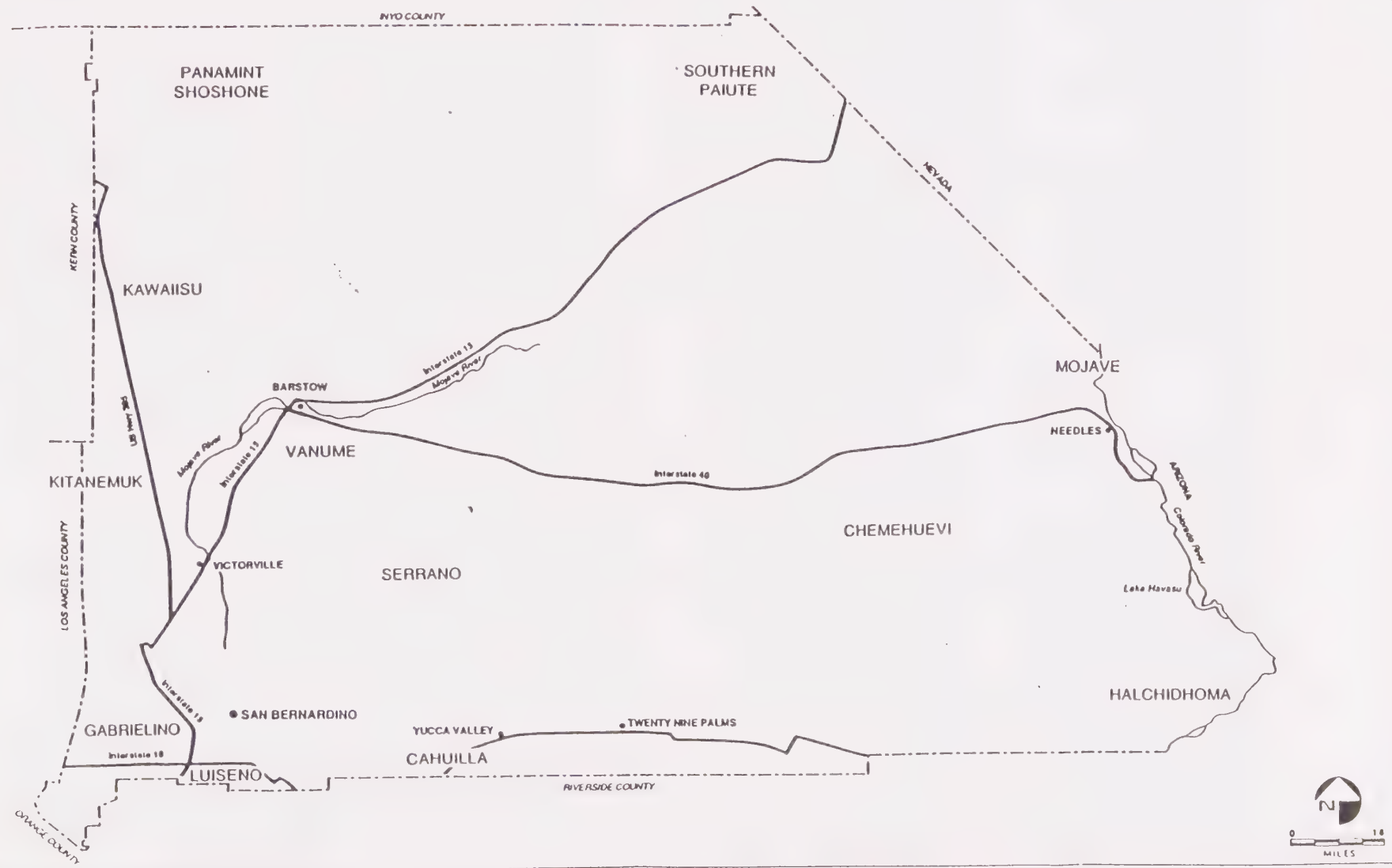
This period includes the Amargosa II and Saratoga Springs complexes which are characterized by projectile point forms of the Rose Spring and Eastgate series. Smaller projectile points suggest that a transition to the use of bow and arrow had been made. Other artifacts, with the exception of ceramics, are similar to the proceeding period. Ceramics make an appearance in the county and suggest contact with southwestern cultures through either trade or migration. In the eastern Mojave, turquoise mining is notable and further suggests association with the cultures of the southwest (Rogers 1929b; Leonard and Drover 1980; Drover 1980; Sigleo 1975).

Late Prehistoric (750 B.P.-Contact)

Diagnostic material during this period, sometimes called the Protohistoric, includes Cottonwood Triangular and Desert Side-notched projectile points and local production of both buff and brown ware pottery. Projectile points suggest use of the bow and arrow. Other items forming the artifact assemblage include a variety of flaked stone tools, basketry, ground stone, and wooden items. The economy is based largely on the gathering of plant foods and the hunting of small game.

Ethnographic Culture (Contact)

The ethnographic inhabitants of San Bernardino County were Numic- and Takic-speaking populations with the exception of the Mojave and Halchidhoma people along the Colorado River who were Yuman-speaking. From west to east these Native American groups are the Gabrielino, Luiseño, Kitanemuk, Cahuilla, Serrano, Vañume, Kawaiisu, Panamint Shoshone, Southern Paiute, Mojave, and Halchidhoma (Figure 2).



Generalized Ethnographic Ranges within the County of San Bernardino

FIGURE 2

The ethnic boundaries of many of these groups have not been determined in part because of the seasonal movements of these ethnographic people. Settlements were focused on water sources such as springs and rivers. The abundant resources along the Colorado River allowed for nearly permanent settlement and the establishment of horticulture. Other
Native American groups existed as hunters and gatherers limited by the resources and environmental conditions.

2. Historical Overview

The history of San Bernardino County is associated with three major periods of occupation associated with Spanish, Mexican and American rule and land use. Particular activities took place during each of these periods that contributed to the growth and development of the county. Historical occupation of the county can not be characterized solely on the basis of political rule or cultural diversity, for settlement and land use was also determined by the physical environment of the area, that includes the presence of valley, mountain and desert land. To facilitate a presentation of the county history and to provide a framework for addressing the presence of historic resources associated with each period, the following discussion provides a brief, general background of events and activities by periods of occupation.

Spanish Period (1769-1821)

The arrival of Spaniards in Upper California in 1769 marked the beginning of settlement throughout the length of the state of California as we know it today. With the political intent of establishing a military foothold and the clerical goal of christianizing the native population, the Spaniards traveled northward from Sonora in Lower California and arrived in San Diego to implement the colonization of Upper California. The first presidio and mission were established in San Diego and within a short time another expedition proceeded further north in search of Monterey Bay as an additional port for the arrival of ships and supplies. Establishment of presidios near strategic bays and a chain of missions led to a network of routes that was to serve as the main artery for travel and transportation in future years.

San Bernardino County is closely associated with the early efforts by the Spanish to expand their territory and support colonization through exploration of the interior region. Transportation of supplies by sea was not always reliable, as ships were often lost or carried far beyond their destination; leaving the colonists without food or supplies. In the early 1770s, several exploration parties proceeded north from Sonora to discover overland routes for transportation of supplies and channels of communication. Exploration by Juan Bautista de Anza and Father Francisco Garcés resulted in the arrival of the first

Anglos in San Bernardino county. Efforts by Garcés, in particular, were successful in establishing a route through the county that led to the San Gabriel Mission.

The early development of the county is closely related to the establishment of the San Gabriel Mission in 1771. The scarcity of supplies necessitated the immediate production of food to supply the missionaries, soldiers and the Indians who were pressed into duty to help plant crops and tend the small herds of livestock brought by the Spaniards. As the mission population grew, there was a need to find additional grazing land for the expanding number of cattle, horses and sheep.

The broad San Bernardino Valley was selected as a suitable area for grazing land and other agricultural purposes, resulting in the establishment of a mission outpost, or ranch, and construction of the first buildings and irrigation system in the area. It was during this period of occupation that new crops from the Mediterranean area were introduced into the county that proved fully compatible with the local climate, and set the stage for later agricultural activities. The production of wheat, grapes, olives, citrus fruit and other agricultural crops flourished along with development of the mission system.

Mexican Period (1821-1848)

Mexico gained independence from Spain under the Treaty of Córdova, signed in 1821. Few significant changes took place in the first decade of Mexican rule, in part because many of the Spanish laws were retained and the mission system continued in operation much as it had in the past. Although a goal of secularizing the missions was first initiated by the Spanish government in 1813, few steps were taken to carry out the intent. Secularization was finally accomplished by the Mexican government in 1934. The act of placing mission property under civil authority resulted in a breakdown of the mission system and dispersal of mission lands in the form of vast grants of land.

Major land grants within the county included: Rancho Cañon de Santa Ana, granted to Bernardo Yorba in 1834; Jurupa Rancho, granted to Juan Bandini in 1838; Cucamonga Rancho, granted to Tiburcio Tapia in 1839; Rancho Santa Ana del Chino, granted to Antonio María Lugo in 1841; Rancho San Bernardino, acquired in 1842 by the sons and a nephew of Lugo; and Muscupiabe Rancho, granted to Michael White (Miguel Blanco) in 1843. These grants are directly related to land use and occupation in the 1830s and 1840s, that resulted in an economy based heavily on pastoral activities associated with the hide and tallow trade. Further development of the ranchos was disrupted by the Mexican-American War, in which American forces eventually gained control of California.

American Period (1848-Present)

Mexican rule officially ended under the Treaty of Guadalupe Hidalgo, signed in 1848, and the American Period began. The early years of this period are characterized by an influx of Americans from the east and of people from foreign countries. The discovery of gold in California, admittance of California to the union in 1850 and the potential for free land influenced the increase in immigration activities. Passage by Congress of the Act of 1851, resulted in creation of a Board of Land Commissioners to determine land ownership status under the Treaty of Hidalgo and settle land disputes. Although many grantees were able to provide proof of title and retain their land, others could not and the land came under public domain. Many of those fortunate enough to prove ownership lost their land as a result of the lengthy proceedings and costly legal services, in addition to economic difficulties brought on by the theft of stock and weather conditions.

The earliest pioneer settlement in the county was started by Mormon colonists who traveled from Salt Lake City in the 1850s to develop purchased land that once constituted the San Bernardino Rancho. A portion of the valley land was divided into parcels for homes and for agricultural purposes. Within a period of a few years the Mormon community had developed a water supply system, erected a flour mill and established sawmills in the San Bernardino Mountains, for the sale of lumber. The Mormons remained active in the area until 1857, when they departed for Utah at the command of the Church Elder. Although some members of the group remained, decreased agricultural and lumbering activities resulted in a gradual disintegration of the Mormon community.

Of the three occupation periods, the American Period represents the greatest diversity and intensity of cultural activities; partially because of the prevailing attitude of opportunities in the west, but also because of the duration of occupation. In the decades preceding and following the Civil War, travel and transportation routes were expanded or created to meet the needs of the increasing population and settlement in the county. Mormon production of agricultural goods and lumber in the 1850s serves as an example of the need for development of routes linking major trade and shipping points. It was also during this period that the Butterfield Overland Mail Company stagecoach passed through the county traveling between St. Louis and San Francisco. Gold was discovered in the county and for a time another wave of immigrants seeking wealth arrived and conducted mining activities in the mountain and desert areas.

In the 1870s, the economic development of the county relates closely to the successful production of citrus fruit in valley lands, improved irrigation systems, and construction of railroad

lines. By 1876, a railroad connection was completed between San Bernardino and San Francisco, and five years later two transcontinental connections were made. Completion of the railroads served to support the citrus industry. Already a popular item on the east coast, the local growers were able to transport greater quantities of citrus fruit to a broader area, resulting in a marketing advantage while spreading news of the mild climate in California. Although the state had been promoted prior to this time as a healthful place to live, the added publicity and the availability of travel by rail served to draw additional people to southern California.

Developers arrived along with those hoping to settle in California, and in combination, the buyers and sellers created an economic boom in the 1880s. Small settlements sprung up on land that was parceled for homes and agricultural crops. New businesses were started to provide for the influx of both tourists and settlers. Water companies were developed to provide services and promote sales. Unfortunately, the land boom lasted only a short time and by the turn-of-the-century many of the new communities no longer existed while others were able to maintain their standing because of the presence of successful citrus groves.

The history presented above represents a brief and very general account of the development of the County of San Bernardino. It s presented for the purpose of providing a spatial and temporal background on cultural activities that contributed to the character of the county. Several excellent sources are recommended for a comprehensive history of the county, including Beattie (1951) and La Fuze (1971). A pictorial view of the county accompanies a history by Schuiling (1984).

3. Regional Studies

Broad overviews and special studies that address the history of the county on a regional basis are also recommended. On the subject of mining, Vredenburgh et al. (1981) provide an overview of mining in the California desert, and Robinson (1977) focuses on mines of the San Bernardinos. A cultural resource overview of the San Bernardino National Forest (Carrico et al 1982) provides an account of historic land use in relation to early cultural activities. An inventory of historic sites located in the central Mojave Desert was accomplished by Gallegos et al (1980), and the subject of historic trails and wagon roads of the California desert has been studied by Warren and Roske (1981). Carrico and Norris (1978) present an overview of land use in the California desert.

A number of recent studies, conducted at the level of cultural resource surveys, provide a record of existing historic resources and historical associations with a focus on project specific areas. Among such studies are those prepared for the U.S. Army

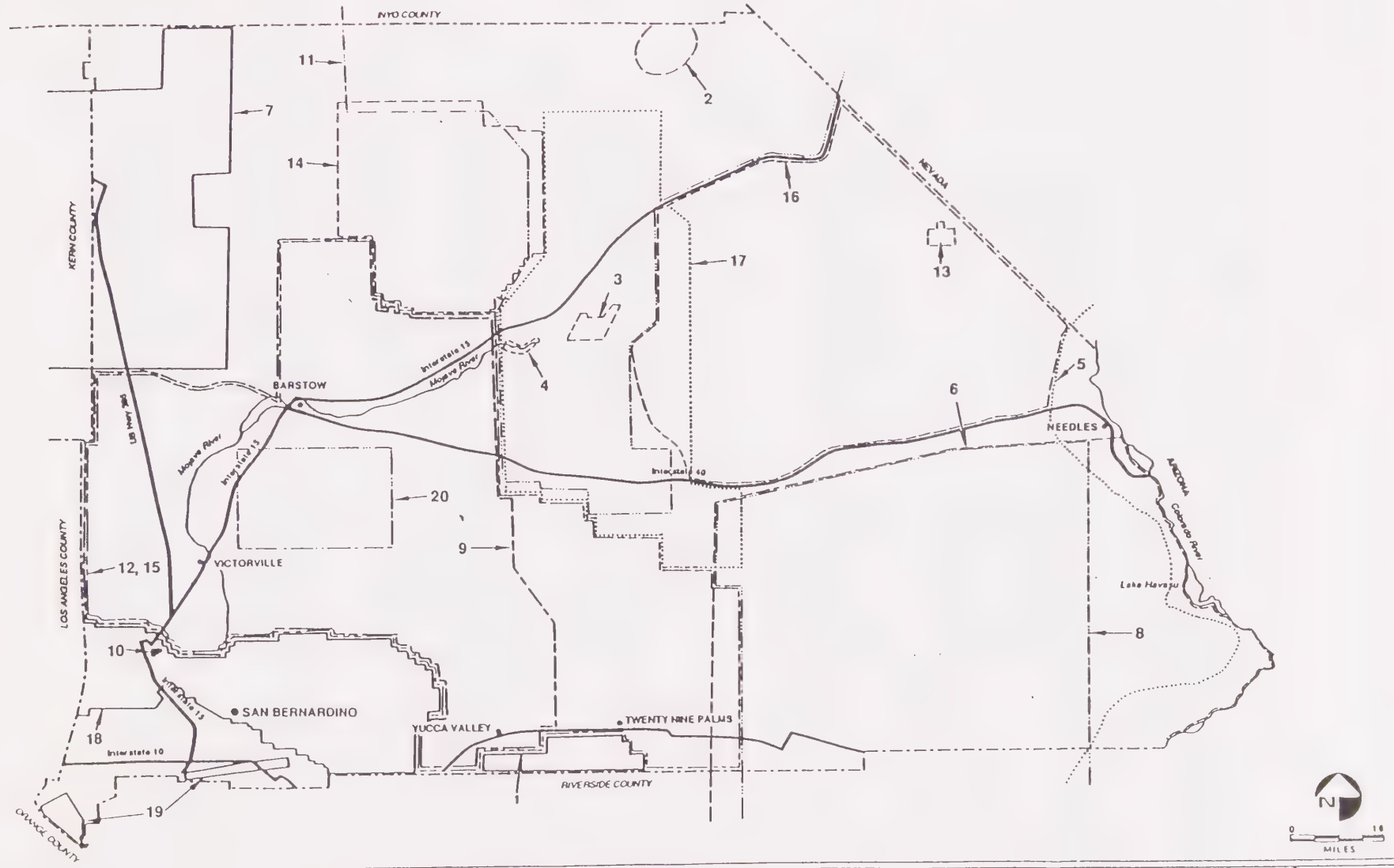
Corps of Engineers, Los Angeles District (Brock 1986; Arnold et al 1987; Foster et al 1988; Hampson 1988).

A number of major cultural resource studies have been conducted in San Bernardino County. These studies have been primarily conducted for federal agencies as planning documents or regional inventories/overviews. The major regional studies for San Bernardino County are shown on Figure 3 and listed on Key to Figure 3.

III. SUMMARY

Over 8500 prehistoric and historic archaeological sites are recorded within San Bernardino County. These sites may date to the Pleistocene Period and certainly include Early Holocene to Protohistoric sites. Early Man sites would fall within the Pleistocene Period and Holocene sites date from 10,000 years ago to historic contact. Historic occupation for San Bernardino County begins in 1770 with Spanish Exploration and includes Mexican and American periods.

San Bernardino County has had a number of regional studies conducted primarily on federal lands, sponsored by federal agencies for planning purposes. These studies are important in that they provide broad general overviews for major portions of the County. Also, a number of important County cultural resource sites are listed on the National Register of Historic Places and on state and local lists. Laws protecting cultural resources include existing local guidelines and state and federal laws.



Regional Studies Conducted within San Bernardino County

FIGURE 3

KEY TO FIGURE 3

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1987 Archaeological Investigations at Afton Canyon (CA-SBR-85), Mojave Desert, San Bernardino County, California. M.S. in Anthropology, University of California at Riverside. 294 pp.

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13.
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PALEONTOLOGIC RESOURCES

I. INTRODUCTION

A. Definitions

1. What is paleontology and what are fossil resources?

- Paleontology is the study of prehistoric life and major events on Earth

Paleontology is the science that deals with life of the geologic and prehistoric past. It is a branch of the Life Sciences zoology and botany, but understanding the prehistoric context of the fossils is dependent upon an understanding of the geologic context in which they occur. Paleontology is therefore considered to be a part of the Earth Sciences as well. Paleontology tells us about relationships between life forms, their origin, evolution and extinction; prehistory climates, ecology, and geography; and adaptations and natural selection.

- Fossils are the remains of animal and plants preserved by natural causes

Paleontology is based on the study of fossils, which are the remains of life forms (animal and plant) and their traces which have been preserved by natural causes.

- Fossil vertebrates come in all sizes

Vertebrate fossils can be as large as dinosaurs or as small as mouse teeth. All vertebrate fossils give us information about the sequence of prehistoric life, and all vertebrate fossils are very important in understanding the earth. Why are fossil whales found in Cajon Pass? Why are 20-foot long fossil basking sharks found in Chino? The first elephants in North America are found at Barstow; where did they come from?

- Fossil invertebrates can be rare and unique

San Bernardino County contains invertebrate fossils such as insects preserved by agate and half-billion year old trilobites that cannot be found anywhere else in the world.

- Fossil plants are important indicators of prehistoric environments

Plant fossils give information about prehistoric climates and environmental changes. Fossil plants in San Bernardino County may be preserved in rocks from the Age of Dinosaurs, or may be mummified remains found in caves and packrat middens.

- Some fossils are preserved as tracks and traces California's only dinosaur footprints are found in San Bernardino County. Tracks of extinct camels, elephants, horses, and birds are found near Barstow and Baker in sediments 15 million years old.

- All fossils indicate prehistoric environments and the history of faulting

Vertebrate, invertebrate, and plant fossils give specific information about prehistoric environments. Their presence in rock units can also give information about the age of the sediments. By dating rock units, data can be developed regarding the timing and movement of faults, mountain building, landslides, erosional patterns, and floods. Using this information, it is possible to understand present-day environmental relationships and predict future geologic and environmental conditions.

2. <u>San Bernardino has a unique fossil record. What are we doing to preserve our heritage</u>?

- Fossils are fragile and irreplaceable resources that are protected by law

All vertebrate fossils and many invertebrate and plant fossils are considered to be significant nonrenewable paleontologic resources and are protected by Federal, State, and local law. The County of San Bernardino is committed to the protection of its unique nonrenewable resources and is required by the California Environmental Quality Act (CEQA) to implement and enforce programs of mitigation for their protection and preservation.

- San Bernardino County is in a unique geographic position which includes the border of two major continental plates

The San Andreas Fault marks the boundary between the Pacific Plate And the North American plate. Our county includes portions of both plates and reflects 20 million years of past activity. Continuing activity is seen by recent volcanoes and constant earthquakes. Fossils give very important specific temporal and environmental information about ongoing fault activity and geologic hazards.

- Fossils in San Bernardino County are a part of the National heritage

Fossils are irreplaceable remains of prehistoric life in North America. San Bernardino County contains deposits of fossils which are recognized as the basis of comparison for fossils of

similar age throughout the world. These "type localities" are of critical significance to the understanding of prehistory throughout the nation and the world. Fossils are themselves an important heritage for the residents of San Bernardino County.

- Fossils give tangible evidence of extinctions of life forms

By studying fossil distribution through time and geographic range, it is possible to gain understanding of the processes leading to the extinction of life forms. This is critically important in evaluating the effect of man's activities in the environment relative to natural changes through time.

- Learning from the past is the key to the future

The study of fossils does not merely provide data for scientists and museums. The study of the history and prehistory of the Earth through the records left by fossils is an important facet of education, teaching respect and understanding for ecologic balance and the relationship between life forms, climate, environment, and the future of the Earth as a living planet. The study of fossils, when related to the development of land forms and tectonic activity, also makes possible predictions of future activity along faults, ancient landslides, and floods that affect everyday life in San Bernardino County.

II. CURRENT STATUS AND ANALYSIS

A. Sources of Data

1. Documentation of paleontologic resources

- The Regional Paleontologic Locality Inventory (RPLI) at the San Bernardino County Museum maintains records of known paleontologic sites in and around San Bernardino County

The SBCM RPLI is the major repository of paleontologic locality data for San Bernardino County. It incorporates pertinent records from other major institutions, including the Los Angeles County Museum, the University of California at Berkeley, and the University of California, Riverside. These records (which are held confidential for the protection of the resources) provide a continuing basis for the evaluation of the potential for previously unsurveyed areas to contain paleontologic resources.

San Bernardino County has more than 3,000 paleontologic localities recorded in the Regional Paleontologic Locality Inventory. Many of these known localities occur on private land which is subject to development; others occur on Federal lands and their resources are protected by Federal agencies such as the Bureau of Land Management and the U.S. Forest Service.

- Published and unpublished literature and geologic mapping helps define the boundaries of fossil-bearing rock units

Fossils and traces of fossils are usually preserved in sedimentary rock units, particularly fine- to medium-grained marine, lake, and stream deposits such as limestone, siltstone, sandstone, or shale, and in ancient soils (paleosols). They are also found in coarse-grained sediments such as conglomerates or coarse alluvium. Fossils are rarely preserved in igneous or metamorphic rock units, but such occurrences are known in San Bernardino County. Geologic maps and reports help define the boundaries of sedimentary rock units, all of which are considered to have the potential to contain fossils.

It is very important to make the distinction between archaeologic resource sites and paleontologic resource sites when defining sensitivity. Archaeological site boundaries define the limit of the extent of the cultural resources. Paleontologic sites, such as those recorded in the Regional Paleontologic Locality Inventory, serve as indicators that the sedimentary unit or formation in which they are found is fossiliferous. The boundaries of a fossiliferous formation, therefore, define the limits of paleontologic sensitivity in a given region.

2. Predicting the potential for paleontologic resources

- All sedimentary rock units in San Bernardino County have the potential to contain paleontologic resources

San Bernardino County is the largest county in the nation, and much of its land surface has not been investigated for fossils. Until survey has shown otherwise in a specific area, information from literature, mapping, and the Regional Paleontologic Locality Inventory indicates that all sedimentary rock units have the potential to contain significant nonrenewable paleontologic resources.

- Fossils often occur beneath the present-day land surface

Fossils may occur throughout a sedimentary unit, and in fact are more likely to be preserved subsurface, where they have not been damaged or destroyed by previous ground disturbance, amateur collecting, or natural causes such as erosion. In contrast, cultural resources are often recognized by surface evidence of their presence. Field survey for paleontologic resources can indicate that sediments likely to contain fossils are present, even if fossils are not observed on the surface. In fact, the act of excavation is often the only way in which fossils are discovered.

- Certain types of deposits are particularly likely to contain fossils. These include:

    - fine, medium, and coarse-grained sedimentary units
    - paleosols (fossil soil horizons)
    - Ice Age lakes and playas
    - packrat middens (mummified remains)
    - cave deposits and natural traps
    - volcanic flows and ash falls
    - concretions (layers of minerals which form around a fossil as a central core

3. Paleohistory in San Bernardino County

- Pre-Paleozoic Era, 1.3 billion years ago

Fossils of single-celled organisms which are among the earliest known fossils in the world are found in San Bernardino County in the Beck Springs Formation. These unique 1.3 billion year old life forms are the world's oldest known mitosing cells.

- Paleozoic Era, 245 to 550 million years ago: The Age of Invertebrates

Exceptional deposits of trilobites, an extinct crab-like animal, occur in shales in the Marble Mountains and in the limestones of the Providence Mountains.

Limestones at Clark Mountain and in the Victorville and Oro Grande areas contain abundant remains of invertebrate corals, brachiopods, and gastropods deposited when oceans covered San Bernardino County.

- Mesozoic Era, 245 to 65 million years ago: The Age of Dinosaurs

The only known tracks of dinosaurs in California are found in San Bernardino County. They are approximately 180 million years old.

Cajon Pass contains the fossil remains of Mososaurs and Elasmosaurs, giant marine reptiles that lived in the Cretaceous Period at the end of the Mesozoic Era. Did these creatures survive the great Cretaceous extinction event and live into the early Cenozoic Era?

- Cenozoic Era, 65 million years to Present: The Age of Mammals

Many vertebrate fossils are known from the Cenozoic Era in San Bernardino County. They are particularly important in that they give information about the timing of faults, which relate directly to today's landforms. The Cenozoic Era is divided into the

Tertiary Period (from 65 million years to about 2 million years ago) and the Quaternary Period, which includes the Pleistocene "Ice Ages" and recent times.

- Paleocene marine sediments: 65 to 57 million years ago

In Cajon Pass, Elasmosaur fossils are found in sediments which suggest that this marine reptile survived past the "extinction of the dinosaurs". Fossil fish and invertebrates are also found in these rocks.

- Miocene continental sediments

The Cady Mountains in San Bernardino County contain the earliest Tertiary vertebrate fossils known in the Mojave DEsert, at 26 million years before present.

The Mud Hills, north of Barstow, contain fossils in the Barstow Formation, which is the type locality of the Barstovian Land Mammal Age, 17 to 13 million years in age. This formation extends to the Yermo (Toomey) Hills and east toward Baker, and fossils are found throughout its exposures. These animals include extinct camels, three-toed horses, primitive elephants called "Gompotheres", giant bear-dogs, and very important small vertebrate fossils including rodents which allow precise dating of the rock units.

Cajon Pass has very important Miocene fossils, including extinct camels, horses, and rodents, in rock units of the same age as those found in the Mud Hills. The geographic location of the Cajon Pass fossil localities are critical to the understanding of the San Andreas Fault and to the rising of the San Bernardino and San Gabriel Mountains.

Pioneertown, in the San Bernardino Mountains, has sediments containing large and small extinct Miocene fossils.

- Miocene marine sediments

Ten million years ago, the ocean deposited the Puente Formation near Chino. This rock unit in the Chino Hills contains very important fossil marine mammals (including whales and seals), fish, and marine invertebrates and seaweeds. Portions of the Puente Formation in the Chino Hills were deposited very close to the Miocene shoreline, and the sediments contain both marine and continental plant and animal fossils (including extinct rhinoceros and elephant). It is very unusual to find marine and continental fossils in the same rocks, and critical environmental information, including the relationships between ocean and land temperatures and climate, can be gained from these fossil assemblages.

- Plio-Pleistocene sediments, 5 to 3 million years ago

Vertebrate fossils from Cajon Pass to Lucerne Valley date from the boundary of the Tertiary and the start of the Ice Age, and thus provide very important information about major changes in climate. These fossils were deposited at the time the San Bernardino Mountains began to rise.

San Timoteo Canyon contains Plio-Pleistocene fossils, including extinct elephants and rodents, which allow the dating of activity along the San Jacinto Fault and the San Andreas Fault at the start of the Ice Age.

- Middle Pleistocene sediments, to 500,000 years before present

Sediments associated with the Mojave River, from Cajon Summit north through Hesperia to Victorville, Adelanto, Kramer, Hawes, Harper Lake, and Calico contain large and small fossil vertebrates including extinct horses, mammoth and mastodon. Small vertebrate fossils in these sediments are particularly important for dating structural and depositional events.

- Late Pleistocene Rancholabrean sediments, 500,000 years to 10,000 years before present

Large and small fossil mammals of the late Ice Age are found throughout San Bernardino County in alluvial deposits, at playa lakes, and in cave deposits.

Fossils of extinct horse were found in river gravels and alluvium south of Etiwanda.

Very significant small and large fossil mammals, birds, and reptiles have been recovered from Manix Lake and from Mojave River sediments near Daggett and Yermo. The youngest fossil of extinct horse known in North America was recovered from the Solar One site near Daggett.

Large fossil mammals have been found near Twenty-nine Palms. Caves near Newberry Springs have yielded fossil mammals as well as cultural remains, and packrat middens near Newberry Springs and in Lucerne Valley contain mummified plant remains which give paleoenvironmental data. Kokoweef Cave in eastern San Bernardino County contains tens of thousands of late Pleistocene and early Holocene fossils which provide extremely important information about climate changes at the start of recent times.

B. CONDITIONS AND TRENDS

1. Impacts to paleontologic resources

- Without proper mitigation, development in certain sedimentary units will cause irreversible damage to irreplaceable significant nonrenewable paleontologic resources

As San Bernardino County continues to develop, unique fossil-containing rock units are being impacted. In areas of intensive development, fossils will be destroyed or become permanently unavailable for future study as construction covers and restricts access to the fossil-bearing sediments. Without appropriate mitigation, irreversible losses of fossils will occur, for example, in the Chino Hills; flat lands along the Mojave River; the San Timoteo Canyon area; the Etiwanda area; the Daggett/Yermo area; in the western Mojave Desert; and on terraces along the Colorado River.

- Proper mitigation in conjunction with ground-disturbing activities associated with development can be beneficial to the preservation of significant nonrenewable paleontologic resources

Adequate and appropriate mitigation procedures for paleontologic resources are carried out in conjunction with project development, concurrent with construction-related excavation. Mitigation is designed to be carried out during the regular schedules of construction excavation and allows adequate samples of fossils and fossiliferous sediments to be salvaged during these activities. By this process, subsurface fossils which would otherwise remain undiscovered may be recovered and preserved. Because fossils are recovered during the course of excavation, their salvage occurs after the impact of ground-disturbing activities. Inevitably, only a sample of the fossils present in an area of construction excavation are recovered.

- Plans to mitigate impacts to paleontologic resources must be prepared and implemented by a qualified paleontologist

Paleontology is a specialized science, and adequate plans for mitigation and implementation of measures of mitigation must be developed and carried out by and under the supervision of a qualified paleontologist. The paleontologist works with the developer to assure rapid recovery of fossils and to avoid delays to construction schedules.

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TECHNICAL REPORT

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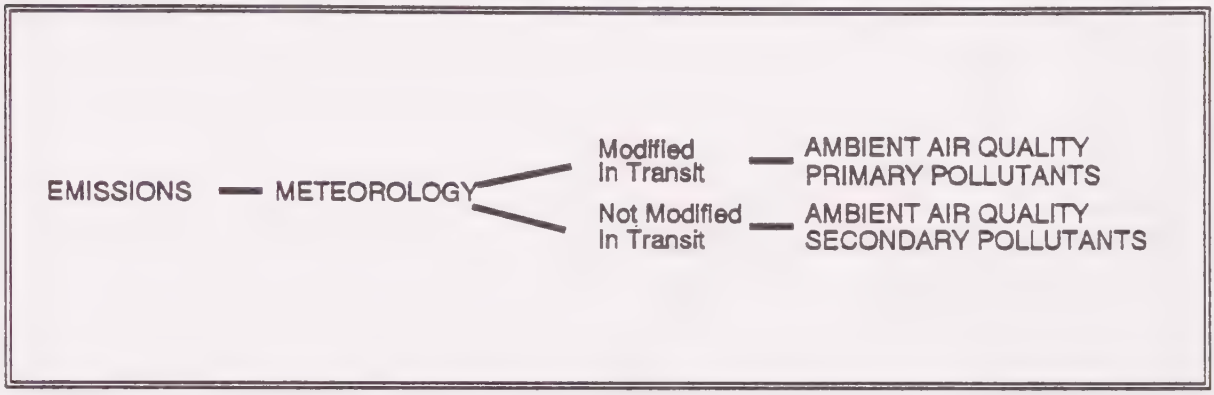
Preface

This report provides the background air quality information and technical documentation for the Regional Air Quality Plan. The primary purpose of this report is to serve as a basis for the formulation of the goals, policies and strategies contained in the Plan. Based on air quality data, Ozone and Particulate Matter were identified as the criteria pollutants that would yield the greatest air quality benefit in the San Bernardino County portion of the South Coast Air Basin.

The San Bernardino County/City air quality planning effort is part of a larger effort to improve air quality in the South Coast Air Basin. The 1989 South Coast Air Quality Management Plan documents existing and future air quality conditions. These data were extrapolated to provide a focused analysis of air quality conditions in San Bernardino County. Projected emissions reductions resulting from implementation of AQMP control measures were similarly applied to San Bernardino County. This information is synthesized with data regarding emission sources and meteorological conditions that are determinate factors in the County's air quality, and results in a determination of pollutants and sources that should be stressed in the Plan.

I. Meteorology and Air Quality Background

Observed patterns of San Bernardino County air quality result from a unique combination of factors. Pollutants are emitted by various sources (stationary "point" sources, linear mobile sources and dispersed area sources), they are transported by prevailing winds horizontally and possibly affected by limits to vertical mixing, and they may be chemically or physically modified in transit before arriving at a specific receptor. Schematically, the air quality process is as follows:



There are federal ambient air quality standards, for six pollutants. And California has exercised the option to add other species, to establish different exposure periods, or to require more stringent compliance than the minimums established in the federal standards. The ambient air quality standards (AAQS) currently applicable in California are shown in Table 1.

Within the South Coast Air Basin (SOCAB) covering southern Los Angeles, western San Bernardino and Riverside and all of Orange Counties, AAQS for ozone (O3), carbon monoxide (CO), nitrogen dioxide (NO2) and 10-micron diameter respirable particulate matter (PM-10) are routinely violated. Other standards are infrequently violated, if at all. The Clean Air Act (CAA) Amendments of 1977 and several court decisions since the expiration of the CAA in 1988 have mandated that the State Implementation Plan (SIP) for each non-attainment pollutant must document the actions to be taken to bring each airshed into compliance with all national AAQS. If local plans which are consolidated at the state level into an SIP do not show future attainment, a federal implementation plan (FIP) must be prepared by EPA and imposed upon any jurisdiction unable to prepare its own satisfactory plan.

TABLE 1
AMBIENT AIR QUALITY STANDARDS

	California		Federal		
Air Pollutant	Concentration	District Method	Primary (>)	Secondary (>)	Method[a]
Ozone	0.09 ppm, 1-hr. avg. >=[*]	U.V. photometry	0.12 ppm, 1-hr. avg.	0.12 ppm, 1-hr. avg.	Chemiluminescence
Carbon Monoxide	9.0 ppm, 8-hr. avg. >[b] 20 ppm, 1-hr. avg. >	Non-dispersive Infra-red Spectrophotometry	9 ppm, 8-hr. avg [c] 35 ppm, 1-hr. avg. >	9 ppm, 8-hr. avg 35 ppm, 1-hr. avg. >	Non-dispersive Infra-red Spectrophotometry
Nitrogen Dioxide	0.25 ppm, 1-hr. avg. > [d]	Gas Phase Chemiluminescence	0.053 ppm, ann. avg. [e]	0.053 ppm, ann. avg. [e]	Gas Phase Chemiluminescence
Sulfur Dioxide	0.05 ppm, 24-hr. avg.>=with ozone>= 0.10 ppm, 1-hr. avg. or TSP >= 100 up/m^3 24-hr. avg. 0.25 ppm, 1-hr. avg. >	Ultraviolet Fluorescence	0.03 ppm, ann. avg. 0.14 ppm, 24-hr. avg.	0.50 ppm, 3-hr. avg.	Para-rosaniline
Suspended Particulate Matter (PM 10)	30 ug/m^3, ann. geometric mean > 50 ug/m, 24-hr. avg. > [f] [**]	Size Segregated Inlet High Volume Sampling	50 ug/m^3, annual [g] arithmetic mean 150 ug/m$^{3,\ 24\text{-hr. avg.}}$	50 ug/m^3, annual [g] arithmetic mean 150 ug/m$^{3,\ 24\text{-hr. avg.}}$	
Sulfates	25 ug/m^3, 24-hr. avg. >=	High Vol. Sampling Methylthymol Blue			
Lead	1.5 ug/m^3, 30-day avg. >=	Cadmium Hydroxide Stractan	1.5 ug/m^3, calendar quarter	1.5 ug/m^3, calendar quarter	High Vol. Sampling Atomic Absorption
Hydrogen Sulfide	0.03 ppm., 24-hr. avg. >=	Gas Chromatography			
Vinyl Chloride	0.010 ppm, 24-hr. avg. >=				
Visibility Reducing Particulates	In sufficient amount to reduce the prevailing visibility to less than 10 miles at relative humidity less than 70%, 1 obs.				

SOURCE: California Air Resources Board, April 1988

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[a] Reference method as described by the federal government. An equivalent method of measurement may be used as approved by the federal government.

[b] Effective December 15, 1982. The standards were previously 10 ppm, (12-hour average) and 40 ppm, (1-hour average).

[c] Effective September 13, 1985, standard changed from > 10 ug/m^3 (>=9.3 ppm) to > 9 ppm (>+9.5 ppm).

[d] Effective March 9, 1987, standard changed from >= .25 ppm to > .25 ppm.

[e] Effective July 1, 1985, standard changed from > 100 ug/m^3 (>.0532 ppm) to > .053 ppm (> .0534 ppm).

[f] Effective August 19, 1983. The standards were previously 60 ug/m^3 TSP, (annual geometric mean), and 100 ug/m^3 TSP , 4-hour average).

[g] Effective July 1, 1987. The standards were previously: Primary - Annual geometric mean TSP > 75 ug/m^3, and 24-hour average TSP > 260 ug/m^3. Secondary - Annual geometric mean TSP > 60 ug/m^3, and 24-hour average TSP > 150 ug/m^3.

[*] ppm = parts per million per volume
[**] ug/m^3 = micrograms per cubic meter

The four pollutants for which the SOCAB is designated as a non-attainment area are mainly secondary pollutants which have undergone some amount of transformation during the transport process. Ozone, for example, is completely a product of the photochemical reaction between reactive organic gases (ROG) and nitrogen oxides (NOx) under abundant sunlight. NO2 and PM-10 distributions are comprised of a combination of some pollution emitted directly and some that has experienced chemical reaction, physical absorption, gravitational settling, etc. CO, conversely, is almost exclusively an unmodified pollutant that has a very slow atmospheric reaction time. An important effect of reactivity and reaction rates in conjunction with prevailing airflow is that patterns of ozone in San Bernardino County are completely controlled by emissions many miles upwind, patterns of ambient NO2 or PM-10 derive from a combination of local sources plus regional effects, while CO air quality results mainly from short transport distance between closely linked sources and receptors.

While the air basin as a whole is not in attainment with national AAQS, San Bernardino County, by virtue of its location relative to prevailing offshore airflow patterns in winter when CO and NO2 are normally high, is in attainment for national standards for these two pollutants because much of the airflow is from unpolluted mountain areas. On the other hand, when regional airflow is mainly onshore in summer and passes over heavily populated areas of the basin, the magnitude of non-attainment for ozone and particulates is among the highest in the basin. Existing air quality in the portion of San Bernardino County within SOCAB is currently monitored by the South Coast AQMD and the California ARB at six county sites. For purposes of comparison, measurement data at Upland, downtown San Bernardino and Crestline/Lake Gregory have been assumed as most representative of the western, central and mountain areas of the County encompassing the major population centriods within that portion of the County within the AQMD. Recently released data from the AQMD show the following compliance status with national AAQS for the most recent (1989) monitoring year:

PERCENT OF DAYS EXCEEDING FEDERAL STANDARDS AND MAXIMUM CONCENTRATIONS

Pollutant	Standard	Upland	San Bernardino	Crestline
Ozone	1-Hour > 0.12 ppm	27%	32%	35%
	Max. 1 Hour Conc. (ppm)	0.32	0.30	0.27
Carbon Monoxide	1-Hour > 35. ppm	0%	0%	ND
	8-Hour > 9. ppm	0%	0%	ND
	Max 1-Hour Conc. (ppm)	8.	11.	ND
	Max 8-Hour Conc (ppm)	5.4	8.1	ND
Nitrogen Dioxide	Annual Avg. > 0.05 ppm	No	No	ND
	Annual Avg. (ppm)	0.045	0.041	ND
Respirable Particulates	24-Hour > 150 ug/m3	7%	5%	0%
	Max. 24-Hour Conc. (ug/m3)	254.*	271.	87.

* Data from Ontario Airport area, no measurement at Upland.

ND No Data, no measurements at this site.

Ozone is the most pervasive problem pollutant with annual maxima of about 170 percent above the allowable national standard. PM-10 levels of 70 percent above the national AAQS were also recorded in 1989. The more localized nature of PM-10 patterns is seen, however, in the fact that Crestline did not even come close to exceeding the federal PM-10 standard in 1989. These data suggest that although the basin AQMP addresses all four non-attainment improvement strategies, those measures related to ozone are of primary importance and those associated with PM-10 are of intermediate importance. CO attainment planning is least critical because CO standards are very infrequently violated. ROG and NOx emissions, as precursors to ozone formation, thus have the greatest impact on County air quality. Although CO is the least significant concern, the fact that CO drains toward the ocean in winter which makes the County a source area for CO non-attainment in coastal areas is very similar to coastal ROG and NOx sources creating County ozone problems in summer. The fact that San Bernardino County is a source area for winter pollution problems requires that efforts to minimize CO emissions need to be as aggressive as summer ROG and NOx controls if the County is not to be a source of somebody else's bad air

quality in winter just as the County is a receptor of coastal corridor air pollution in summer. While the following discussion stresses the ozone problem in the County from spring through fall, the relative importance of other pollutants in other seasons should not be completely ignored.

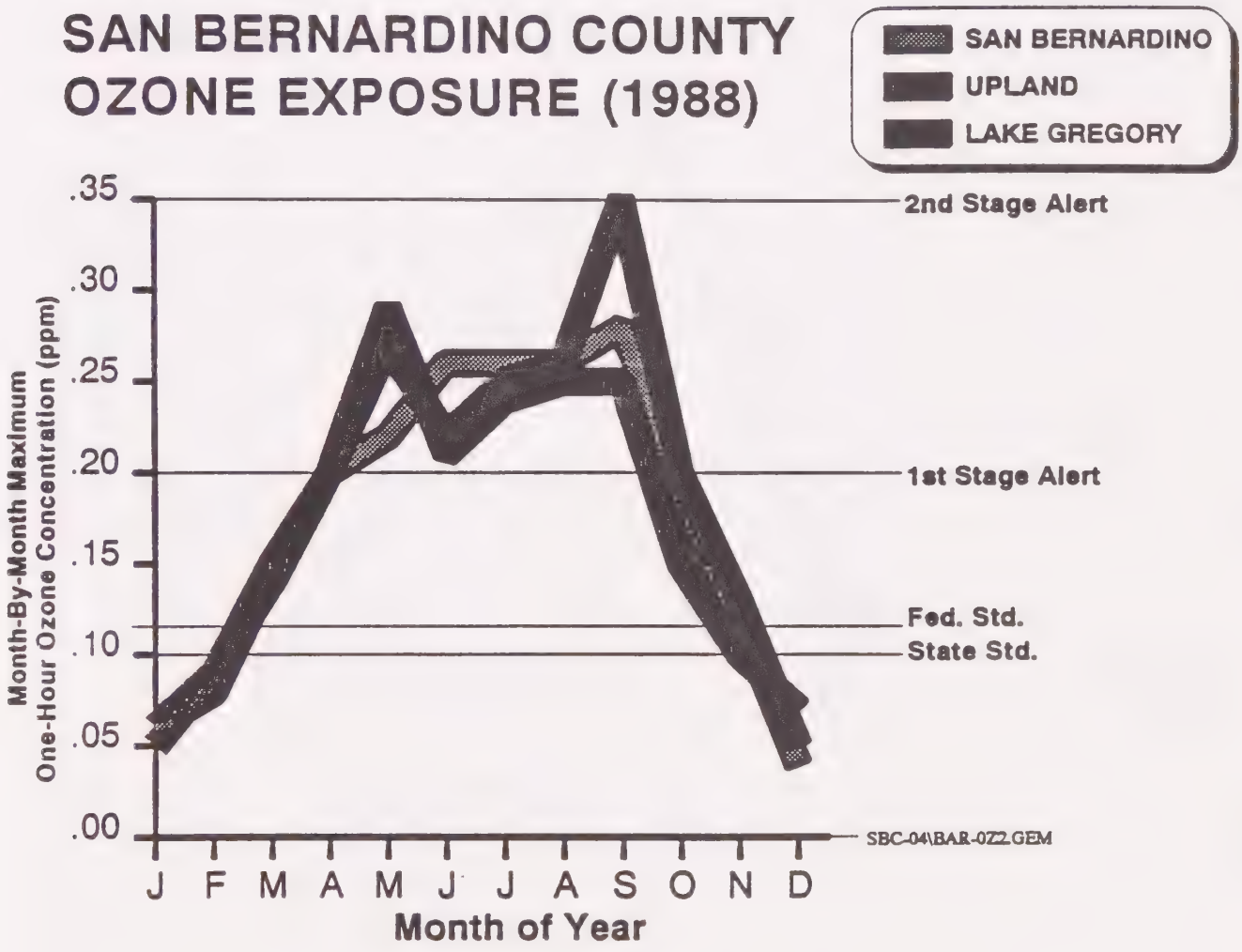
Ozone impedes breathing, destroys vegetation, rots rubber, oxidizes paint and is thus the primary component of the negative affects associated with smog episodes in inland valleys of the basin. Figure 1 shows that ozone levels exceed the national hourly standard from March to November with "smog episodes" possible from April to October. Violation of the standard are harmful to the most sensitive receptors while episode levels are potentially harmful to all people exposed to such levels. Figure 2 shows that while June to August are the smoggiest months, ozone peaks of ten occur in May or September. The annual peaks are associated with strong inversions, high temperatures, and weak Santa Ana conditions where ozone precursors are carried seaward for several days, and then reverse onshore as the onshore winds are again established. This recirculation of aged pollutants first seaward and then again onshore leads to the ozone "spikes" seen in Figure 1 in late spring and early fall.

Because ozone formation is a function of emissions density as well as solar intensity, areas of the County along the western boundary have their ozone peak somewhat earlier than central County or mountain communities as seen in Figure 3. Maximum ozone levels in Upland occur about one hour before downtown San Bernardino, which is about another hour earlier than in mountain communities. Figure 3 also shows that the primary time period of concern for ozone exposure is from about 10 a.m. to 6 p.m. As the basinwide precursor emissions centroid shifts eastward over time, the timing of the ozone peak also shifts slightly because the travel and reaction distance is shortened. It also moves the basin ozone "hot spot" farther east as it has moved from downtown Los Angeles in the 50s to Pasadena in the 60s to Azusa in the 70s to the western County boundary in the 1980s.

Other criteria pollutants, especially those that result from a combination of direct emissions plus atmospheric processes, have somewhat different seasonal patterns. Particulate levels shown in Figure 4 rise in the summer as the ozone formation process generates secondary fine particulates and the trapping inversion aloft puts a lid on the basin. They continue to rise further into the fall, however, as six months of negligible rain creates a dust buildup on roadways and any soil disturbance creates dust clouds because of soil dryness. It is not until the first rains of late fall that there is a dramatic drop in dust/haze when visibility dramatically increases. With weak winter inversions, little photochemical activity and a cleansing action from rainfall, winter and early spring are most dust free.

ANNUAL VARIATION IN SAN BERNARDINO COUNTY OZONE EXPOSURE (1988)

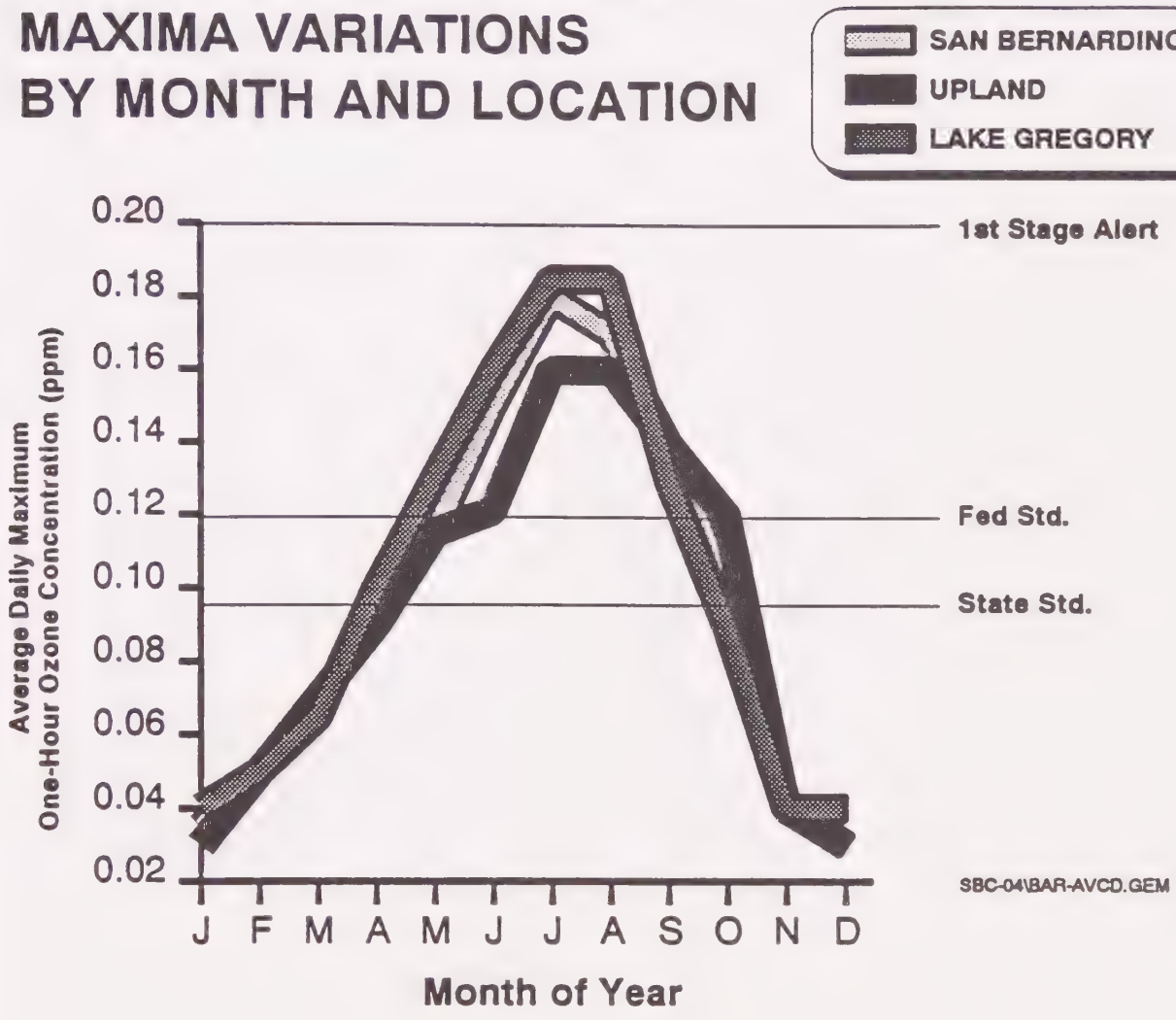
Figure 1



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AVERAGE DAILY OZONE MAXIMA VARIATIONS BY MONTH AND LOCATION

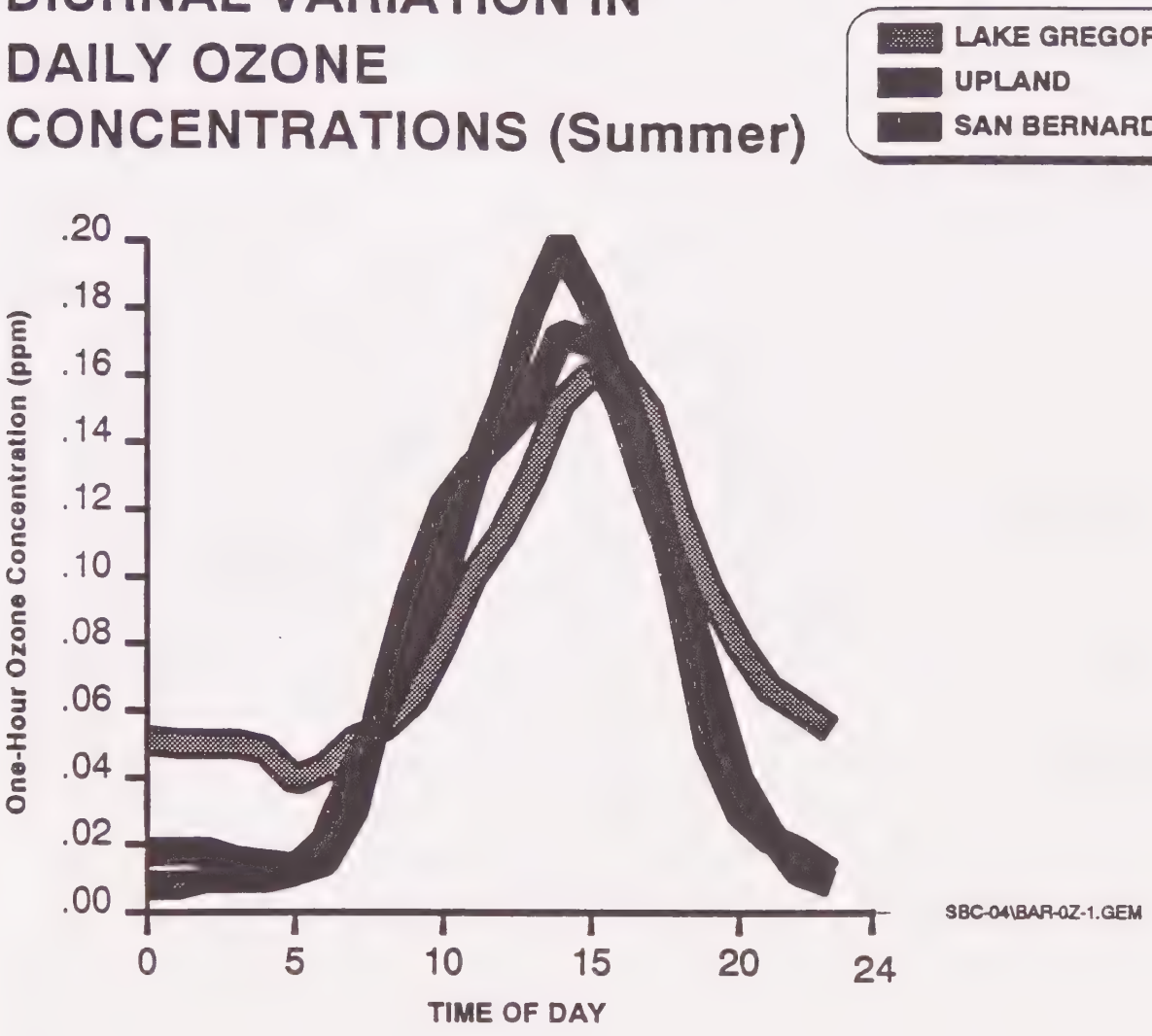
Figure 2



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Figure 3

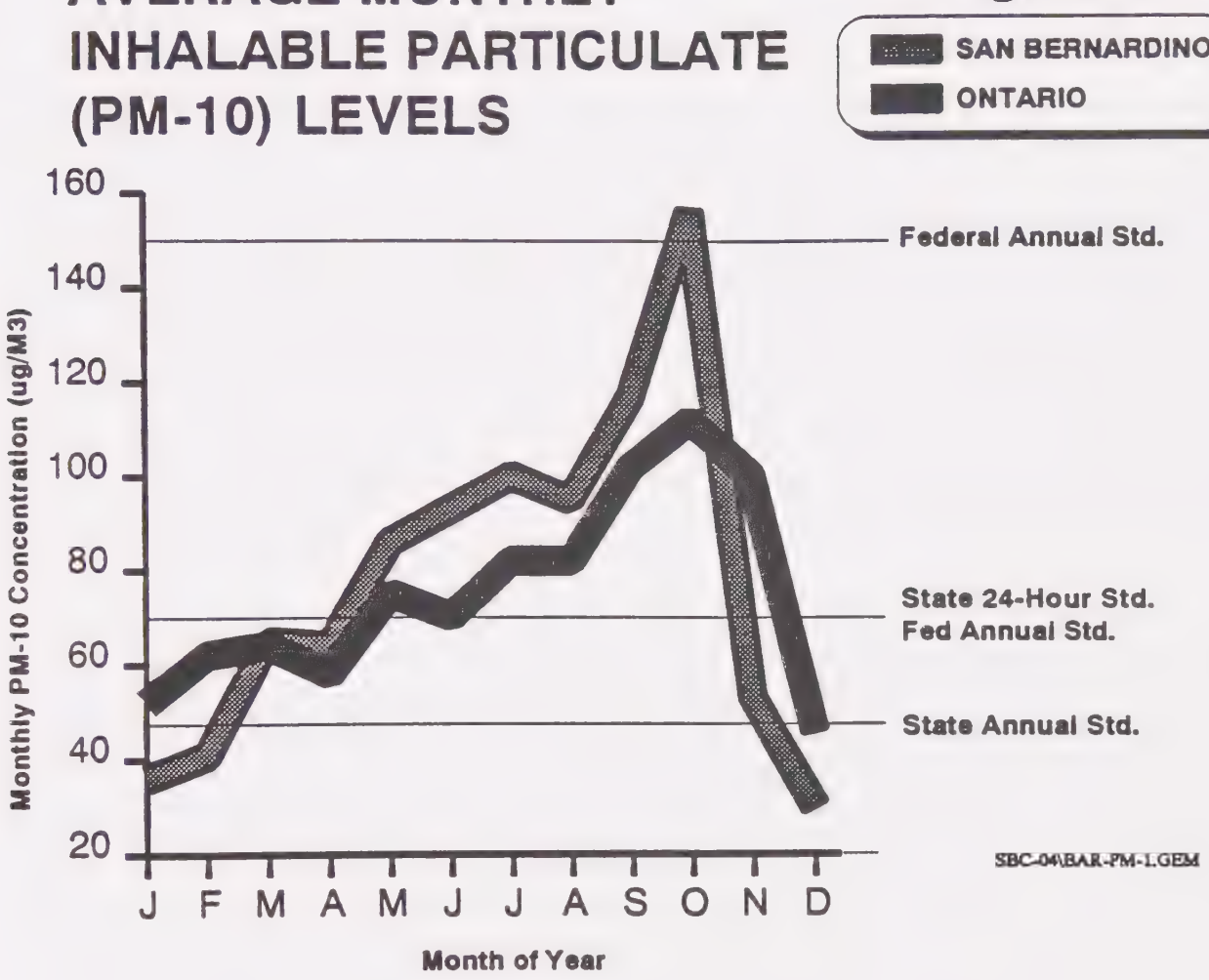
DIURNAL VARIATION IN DAILY OZONE CONCENTRATIONS (Summer)



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AVERAGE MONTHLY INHALABLE PARTICULATE (PM-10) LEVELS

Figure 4



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Ozone, and to some extent particulates, are governed by the regional "marine-subsidence" inversion covering the basin at around 1,500 above the surface. CO and NOx, however, are more impacted by low-level nocturnal radiation inversions. These inversions are shallow and form mainly on winter nights with light winds. The monthly CO peaks from 1988 shown in Figure 5 and the corresponding Nox distribution in Figure 6 reflect the importance of local trapping action on seasonal air quality. These figures also show that the relatively unpolluted air draining down off the San Bernardino Mountains creates a low pollution baseline such that the localized addition of CO and NOx to the airstream still allow for attainment of AAQS for these species. Hourly CO levels are seen to peak near their allowable 8-hour standard while NO2 levels remain well below the state standard. Control of CO and NOx has more of a benefit to coastal communities as the baseline continues to increase when air from San Bernardino County drains westward during the night during cooler months. The indirect benefit of better controlling winter CO and NOx on a basinwide scale is that it will also control summer ROG and NOx when these pollutants critically affect County ozone levels.

Emissions control during the warmer months (and perhaps also the time of day as a control factor) needs to occur on a total regional basis because of the unique combination of summer winds and the basin trapping inversion. Figure 7 shows an idealized wind pattern during the mid-morning hours in summer when the pollutants are released that will convert to ozone in the early afternoon. Four primary wind trajectories characterize "smog season" airflow patterns. These characteristic streams are the reason that as the emissions centroid moved eastward over the last 30 years, as trajectories I, II and then III became the dominant ozone-carrying airstreams. These flow patterns are obviously idealized such that one should not conclude that emissions from Long Beach will always end up in San Bernardino, but not those from Torrance, but they certainly point out that there is a strong spatial relationship between emissions reduction in one part of the basin and air quality improvement in a downwind receptor area. Emissions reductions in the Santa Monica Bay most benefit the downtown area or the eastern San Fernando Valley, pollutants from the South Bay end up in the western San Gabriel Valley, and those from Orange County end up mainly in Riverside County. The emissions from southern through eastern Los Angeles County and far northern Orange County are those most likely to create observed San Bernardino County ozone patterns.

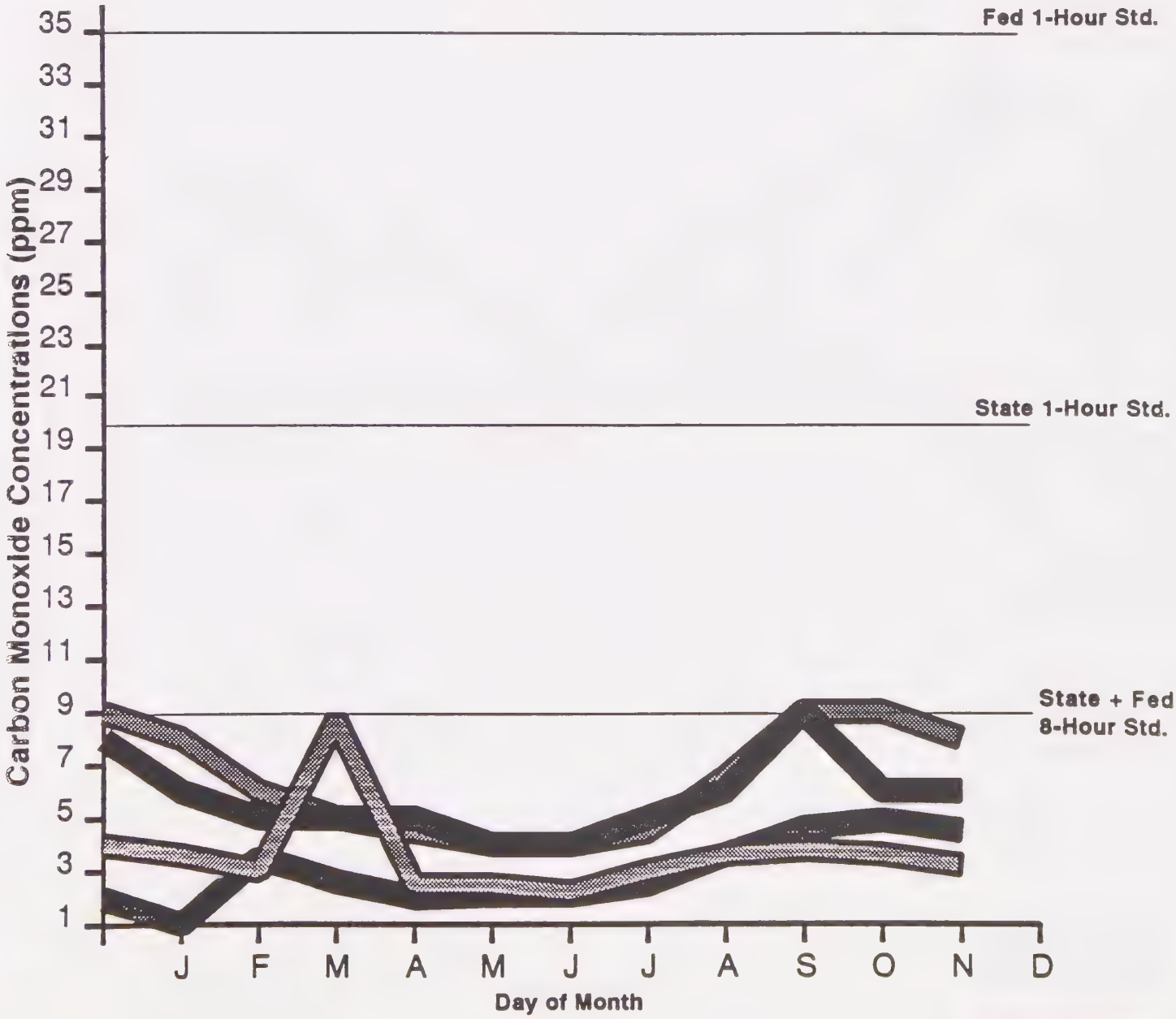
The reaction rate in converting ROG and NOx to ozone varies for the several hundred ROG species participating in the photochemical smog formation process. The fastest reactions under maximum ultra-violet intensity can occur in less than an hour while slower reactions under lower sun angles can take many hours. As an average, 2-4 hours in the ambient air is a reasonable range in which the pollution transformation likely occurs. One can then look along the upwind trajectory of air coming into a given receptor site and determine the area of maximum impact/benefit in terms of any location-specific or time-specific strategies to reduce ROG and NOx ozone-formation precursors. Such an analysis was performed for the Ontario area as representative of a western County receptor and for downtown San Bernardino as a central County exposure location. Airflow maps from the South Coast AQMD (Keith, 1980) were used to determine the source area for air arriving at 10 a.m., noon, 2, 4 and 6 p.m. at these two locations. These ten (10) back-trajectory maps are incorporated as an Appendix to this report.

Figure 5

COUNTY CARBON MONOXIDE LEVELS BY MONTH AND LOCATION

SOLID = Monthly Peak Hour
DASHED = Average Monthly Peak Hour

SAN BERNARDINO MONTHLY PEAK HOUR
SAN BERNARDINO AVERAGE MONTHLY PEAK HOUR
UPLAND MONTHLY PEAK HOUR
UPLAND AVERAGE MONTHLY PEAK HOUR



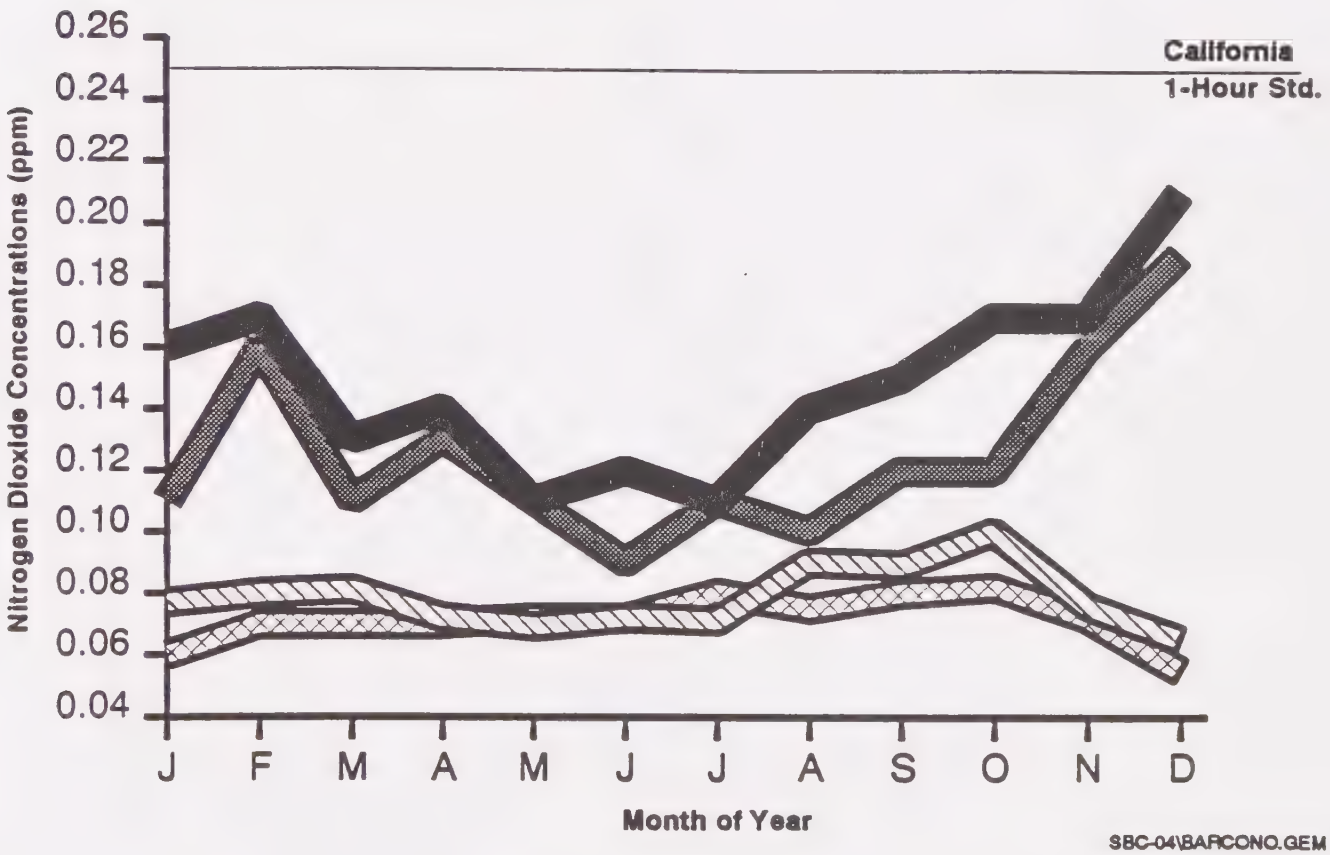
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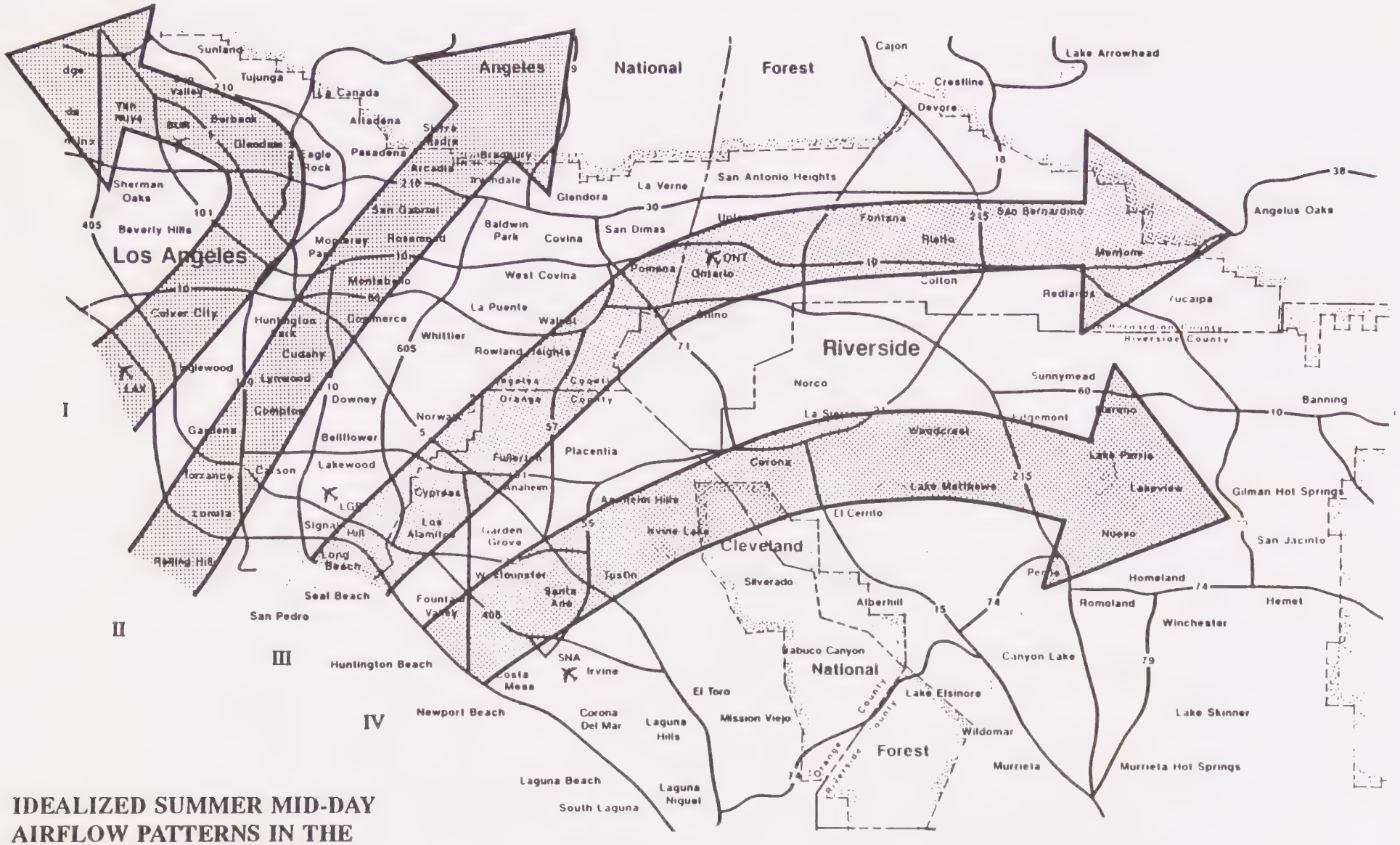
COUNTY NITROGEN DIOXIDE LEVELS BY MONTH AND LOCATION

Figure 6

SOLID = Monthly Peak Hour
DASHED = Average Monthly Peak Hour



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IDEALIZED SUMMER MID-DAY AIRFLOW PATTERNS IN THE SOUTH COAST AIR BASIN

The maps show the general location of the air for up to ten hours before it arrives at the two receptor locations. The general conclusion is that air arriving during mid-morning has been meandering around far eastern Los Angeles and far western San Bernardino County all night long, but that the airflow becomes progressively stronger and better organized by noon to 2 p.m. at the peak of the daily smog curve. The general conclusion that should be drawn from these plots is that Upland/Ontario is impacted almost exclusively from sources outside the County in the 2-4 hours of transit and conversion. Downtown San Bernardino does have some source areas within the far western County that may contribute to ozone formation around noon in the four hours since release around Ontario, but that emissions within the County itself are really moderately important to summer ozone levels only when they reach the far eastern portion of the part of the County within the AQMD, and to some extent the mountain communities at Gregory, Arrowhead or Big Bear. An important consideration of these plots is that a westward morning commute by County residents from the rapidly developing Upland/Cucamonga/Fontana/etc. area releases those emissions squarely into the airflow blowing back across the County, especially if the emissions are exacerbated by congestion which causes ROG emissions per mile of travel to substantially increase. It would be better to reverse to commute direction eastward so that emissions are blown out of the populated areas before they have time to react rather than being released exactly within the air parcel that is going to be passing through the middle of the County at mid-day as smog levels are approaching a maximum. To be sure, shifting the emissions pattern simply moves the ozone problem closer to the mountains or the communities farthest east. However, the convective cells along heated mountain slopes have a much better chance of diluting the emissions to reduce the smog formation rate, plus the total population exposure index (number of people exposed times their individual ozone exposure) is much reduced by a smaller receptor population.

In terms of actions within the County on ROG and/or NOx control that will directly benefit County residents, the Ontario/Upland area is a source area of moderate sensitivity to the downwind communities, particularly what happens in the area from around 6-10 a.m. Control actions farther east in Colton or San Bernardino have a very limited effect because the air parcel into which the precursors are released is well out of the area before the photochemical reaction process is completed. The County is, therefore, not completely at the mercy of upwind sources outside the immediate environment, but the emissions reduction benefit to County residents for the same degree of reduction is much higher for a source in Los Angeles County than for any sources within the County itself.

That conclusion is further strengthened by the fact that San Bernardino County contributes only about 10 percent of the total basin air pollution burden such that any ability to significantly influence emissions is limited by the fact that the County only has a small portion of the total burden with which to work. The last complete basin inventory was developed by the AQMD for 1985 as part of the 1989 AQMP development process. The relative contribution of sources within San Bernardino varies somewhat for each pollutant, but is well under 10 percent for each of the four critical species shown as follows:

Pollution Species	Daily Basin Emissions (tons/day)	S.B. County Emissions (tons/day)	S.B. County Share (%)
Reactive Organic Gases	1264.4	107.9	8.7%
Nitrogen Oxides	1039.8	85.1	8.2%
Carbon Monoxide	5430.1	409.0	7.5%
Particulate Matter	1645.3	141.6	8.6%

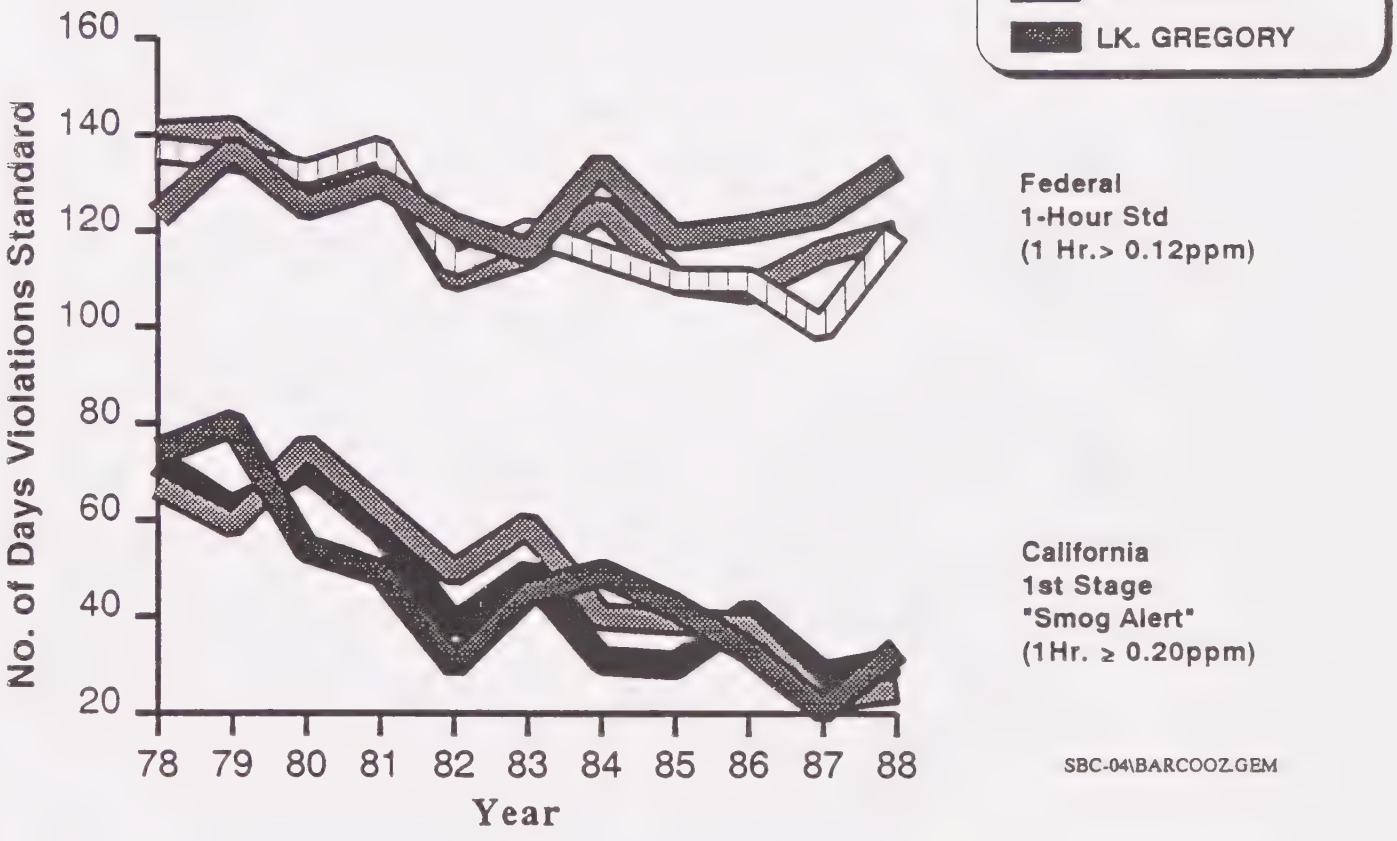
If discretionary air quality actions by jurisdictions within San Bernardino County could modify the inventory by even as much as 10 percent beyond any already mandated pollution control actions, that still only constitutes less than a 1 percent variation in the overall basin distribution. Given further that the benefit of in-County action is somewhat diluted by the prevailing wind pattern compared to similar actions farther upwind, the most important benefit of an aggressive pollution reduction strategy further accelerated by the County Air Quality Element is to serve as an example to upwind source areas more than to effect any substantial change in the current County ozone environment. As previously noted, the most critical factor in pollution control, particularly from mobile sources, is that San Bernardino County residents need to live and work in close proximity. This is especially true since the emissions from a westward morning commute blow back directly across the County during the peak smog formation hours. Although the quantity of control potential is limited, the quality of reduction can be strongly enhanced with better jobs/housing balance.

The regional air quality environment to date has been characterized by very unhealthful ozone exposure, but also by a very marked improvement in air quality. Figure 8 shows the 10-year trend in the violations of the national AAQS for an hourly ozone exposure and for the frequency of first stage smog alerts at Upland, San Bernardino and Lake Gregory/Crestline. Figure 9 shows that "smoggiest" hour observed in any given year in the same 1978-88 time period. The number of violations has slowly decreased, but obviously there are still more than enough precursor emissions to create a violation on days with poor dispersion even after the various control programs to date have been implemented. The dramatic improvement has been in the episode frequency and the annual peaks. The number of first stage alerts has been cut in one half in the County in ten years.

SAN BERNARDINO COUNTY OZONE TREND

Violations of Federal Standard (1st Stage Episode Alert Level)

Figure 8

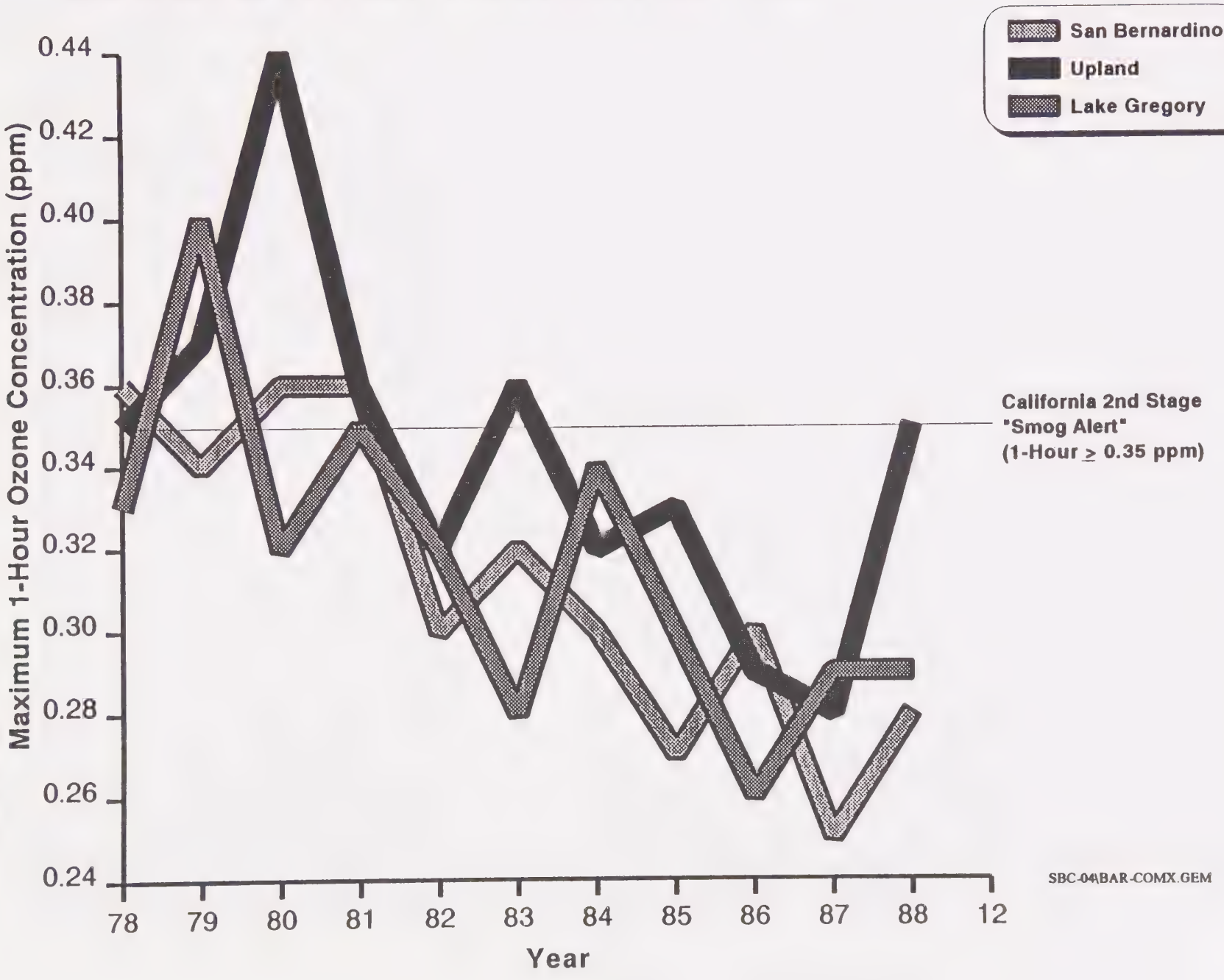


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THE PLANNING CENTER

SAN BERNARDINO COUNTY ANNUAL MAXIMUM OZONE CONCENTRATION

Figure 9



THE PLANNING CENTER

There has been only one second stage episode level (1-Hour ≥ 0.35 ppm) in the last six years (there were none in 1989) in San Bernardino County. The air quality climate, especially those episodes unhealthful for all people and not just the most sensitive, has, therefore, improved spectacularly. Projecting the episode trends forward suggests that any future second stage episodes are unlikely, and that the frequency of first stage episodes will approach zero early into the next century. Unfortunately, recent evidence has shown that chronic exposure to ozone, even at near attainment levels (0.12 ppm for one hour), may be more unhealthful than previous studies have shown. The very rapid population growth also significantly increases the exposed population base such that the total population does is decreasing more slowly since growth in receptors is balancing improvement in air quality. Extrapolation of the national AAQS violation trend line at the current rate of progress of about 15 fewer days of violation per decade suggests that it will take 80 years to finally reach the national ozone standard. The more stringent state standard will obviously take even longer. Such progress is legally and morally too slow.

The ozone attainment trend is even more discouraging in light of the emissions projections for the County and the air basin which show that for all the air pollution control programs in place at the time the current AQMP was developed, the existing improvement rend will slow by the year 2000, and reverse itself significantly by 2010. Under current baseline conditions, the effects of growth and congestion will completely off-set any future emissions reduction benefits such that ozone levels in the year 2010 should be almost identical to those in 1990 except that a much greater number of people will be exposed. Some continued eastward shift in the pattern of exposure is predicted following the housing migration pattern, but overall ozone levels will stagnate at their current levels if the baseline trend continues.

II. 1985 Baseline Projections

A detailed analysis of baseline emissions projections in the absence of new control programs has been performed to identify the types of sources and emissions "hot spots" that most impact County and regional air quality. Future patterns can/will not follow the baseline since there are legal mandates to develop an attainment plan/program, but the baseline is the point of departure of any such plan or program. The emissions inventory for 1985, along with projections for the years 2000 and 2010, were used to characterize existing and future San Bernardino County contributions to the basin burden. The AQMD provided a County-by-County breakdown of the 1985 inventory, but only basinwide future baseline projections. The basin inventory and projections, along with an interpolated existing (1990) inventory, are shown in Table 2 for three generic emissions classes (fixed location sources, on-road vehicles, and non-roadway mobile sources such as planes, trains, construction equipment, etc.). The interpolation for 1990 was performed by a linear approximation for the stationary and non-roadway sources while the on-road mobile sources were weighted according to changes in emissions from the average vehicle fleet between 1985 and 1990. As previously noted, the basin emissions level for 2010, particularly for ROG and NOx as ozone precursors, are almost identical to 1985 and higher than 1990. The mobile source ROG is the only basin pollution sub-category that is less in 2010 than in 1990.

TABLE 2

SOUTH COAST AIR BASIN
Emissions Inventory and Future Projections - Baseline Case

		Emission (tons/Day)			
		1985	**1990**	**2000**	**2010**
R O G	Stationary Sources	590.5	610.6	650.8	699.0
	On-Road Mobile Sources	577.6	417.3	256.9	326.1
	Off-Road Mobile Sources	78.2	89.3	111.6	128.7
	Total All Sources	**1246.3**	**1117.2**	**1019.3**	**1153.8**
C O	Stationary Sources	190.6	192.8	197.3	205.0
	On-Road Mobile Sources	4751.3	3878.5	3005.8	3938.2
	Off-Road Mobile Sources	488.2	552.6	681.9	781.1
	Total All Sources	**5430.1**	**4623.9**	**3885.0**	**4924.3**
N O x	Stationary Sources	285.6	275.3	254.3	271.0
	On-Road Mobile Sources	619.0	548.0	477.0	570.3
	Off-Road Mobile Sources	135.2	147.9	173.4	192.2
	Total All Sources	**1039.8**	**971.2**	**904.7**	**1033.5**
PM-10	Stationary Sources	1548.5	1737.4	2116.2	2298.1
	On-Road Mobile Sources	84.2	89.9	95.6	111.2
	Off-Road Mobile Sources	12.6	13.4	15.0	16.4
	Total All Sources	**1645.3**	**1840.7**	**2226.8**	**2425.7**

Source: AQMP Draft Appendix III-A - 1985 Emissions Inventory
III-B - Future Baseline Emissions

When the same growth factors are applied to the County portion of the inventory, the mobile source growth of light duty auto VMT even reverses the mobile source ROG trend as shown in Table 3. San Bernardino County would have substantially higher emissions in 2010 than 1990 for every pollutant and sub-category when the basin inventory is disaggregated to the County level. A detailed analysis of the relationship between County and basin pollution emissions between Tables 2 and 3 is shown in a sequence of "pie charts" in Appendix B. The major conclusion of this analysis can be summarized as follows:

COUNTY SHARE OF BASINWIDE BURDEN (%)

Pollutant	1985	1990	2000	2010
ROG	8.7	9.6	10.3	10.6
NOx	8.2	9.2	10.6	11.0
CO	7.5	9.0	10.9	11.4
PM-10	8.6	8.7	8.9	9.0

The 200+ percent increase in VMT in San Bernardino County under the baseline assumption leads to the County being a greater contributor to the overall burden, but only by a few percent from slightly under 10 percent to slightly over 10 percent in two decades of continued growth.

In order to isolate where the most substantial changes in the baseline can be effected, the spatial distribution of emissions was analyzed in some detail. The overall baseline pattern of current and future emissions in San Bernardino County was plotted for all source distributions (point, area and line sources) for ROG, NOx and CO for 1985, 2000, 2010. (PM-10 plots are not available, and a 1990 interpolation has not been performed by the AQMD.) These distributions are shown in Appendix C. As with the overall inventory, they show a reduction from 1985 to 2000, and an emissions increase beyond 2000 that erases all previous gains. The spatial patterns show that currently there ar two major emissions areas centered on the Ontario and San Bernardino/Colton areas, but that projected future growth in the Rancho Cucamonga/Fontana/Rialto area will blend these two emissions centroids into a single large source area. As previously noted, the zone of maximum, but limited, emissions sensitivity for County residents is along the western border of the County. Since this is a "hot" zone throughout the 20 year projection period, any locally "fine tuned" emissions control efforts should certainly concentrate on the I-10 Corridor in the Ontario area as the zone of maximum potential benefit.

TABLE 3

SAN BERNARDINO COUNTY
Emissions Inventory and Future Projections - Baseline Case

		Emission (tons/Day)			
		1985	**1990**	**2000**	**2010**
R O G	Stationary Sources	50.8	52.5	55.9	60.1
	On-Road Mobile Sources	42.3	38.3	28.3	38.3
	Off-Road Mobile Sources	14.8	16.9	20.4	23.5
	Total All Sources	**107.9**	**107.7**	**104.6**	**121.9**
C O	Stationary Sources	17.3	17.5	17.9	18.6
	On-Road Mobile Sources	326.3	326.0	313.5	435.8
	Off-Road Mobile Sources	65.4	74.0	91.4	104.7
	Total All Sources	**409.0**	**417.5**	**422.8**	**559.1**
N O x	Stationary Sources	20.8	20.1	18.5	19.8
	On-Road Mobile Sources	47.5	50.7	55.5	70.0
	Off-Road Mobile Sources	16.8	18.4	21.6	23.9
	Total All Sources	**85.1**	**89.2**	**95.6**	**113.7**
PM-10	Stationary Sources	133.7	150.0	182.6	198.3
	On-Road Mobile Sources	6.4	8.8	13.7	17.3
	Off-Road Mobile Sources	1.5	1.6	1.8	2.0
	Total All Sources	**141.6**	**160.4**	**198.1**	**217.6**

Source: AQMP Draft Appendix III-A - 1985 Emissions Inventory
III-B - Future Baseline Emissions

To further identify possible areas of emissions reduction potential, the source distribution was further analyzed to identify those "major" pollution sources under AQMD permit over which any locally initiated discretionary action would likely have little effect. Of the approximately 1,000 major pollution sources in the SCAQMD (emitters of more than 10 tons/year of any pollutant), 67 are located in San Bernardino County. A tabular summary and spatial plot for each pollutant is shown in Appendix D. The point source plots generally mirror the gridded data of centroids in Ontario and Colton/San Bernardino, except that there is also a concentration of emissions in the Etiwanda/I-15 Corridor area from some heavy industry, the power plant, etc. When the average daily emissions from the major sources are compared to the estimated 1990 County inventory, the fact that only a limited percentage of emissions are from major sources is readily seen as follows:

Pollutant	Major Sources (tons/day)	All Sources (tons/day)	Major Source Share of Total
ROG	12.26	107.7	11.4%
NOx	18.00	89.2	20.2%
CO	14.37	417.5	3.4%
PM-10	1.83	160.4	1.1%

A very significant fraction of County emissions are obviously due to on-road vehicles and small pollution sources that may be amenable to selective reduction either through mandatory AQMP measures not related to these major sources or from local discretionary actions.

III. 1989 AQMP IMPLEMENTATION

Although the basinwide air quality distribution is somewhat sensitive to the ROG to NO_x ratio in terms of ozone reaction rates, the general finding of air quality modeling is that basinwide ROG and NO_x each must be reduced to around 250 tons/day or less in order to attain the federal one-hour ozone standard. That represents approximately a 75-80% reduction from current levels while simultaneously off-setting emissions increases from an anticipated major population increase within the next 20 years. As shown in the baseline emissions projections, growth will almost exactly cancel any emissions reduction benefits from air pollution control programs in place prior to the adoption of the 1989 AQMP.

Implementation of the AQMP, in conjunction with requirements of the California Clean Air Act (AB-2595) is designed to achieve a 5 percent air quality improvement in each year of a 20-year cycle. Although the intended improvement is in ambient air quality, the planning for such improvement is generally done in terms of the emissions that ultimately create the observed air quality. It is an iterative process where the degree of potential reductions is estimated, the resulting air quality is modeled using an urban airshed photochemically active simulation, and further reductions are sought of the previous round of planned reductions was insufficient to predict attainment. This process was repeated a number of times to develop the AQMP. By coupling the emissions projections to anticipated patterns of growth, the spatial variation of emissions and its effect on future air quality can also be taken into account.

Emissions projections based on application of existing technologies (Tier I), emerging technologies (Tier II) and future technologies (Tier III) have been calculated by AQMD staff by developing a future "No AQMP" baseline, and then subtracting out the effects of AQMP implementation from the baseline projections until the 75-80% needed reductions were attained. Table 4 shows the overall results of this process on a countywide and basinwide scale based on the gridded plots of the expected emissions pattern shown in Appendix E.

Implementation of the AQMP at 100% of reduction expectations is seen to derive about one-half of its effect from Tier I strategies, to reach three-fourths of its target after Tier II, and to end up with a reduction of 80% each of ROG and NO_x and 90% of all CO at the end of Tier III. There is some slight variation in the rate of expected countywide emissions control/reduction compared to the regional factors, but the control percentage in San Bernardino County is identical to the region as a whole.

TABLE 4

EMISSIONS REDUCTIONS FROM AQMP IMPLEMENTATION

	SOCAB BASINWIDE			SAN BERNARDINO COUNTY		
	ROG	NO_x	CO	ROG	NO_x	CO
Existing (1990)	1117.2	971.2	4623.9	107.7	89.2	417.5
2010 Baseline*	1153.8	1033.5	4924.3	128.0	122.8	531.2
2010 Tier 1*	662.6	502.3	2609.5	66.8	56.8	303.7
Change from Base	(-43%)	(-51%)	(-47%)	(-48%)	(-54%)	(-43%)
2010 Tier 2*	423.9	335.0	1910.2	48.6	38.0	235.6
Change from Base	(-63%)	(-68%)	(-61%)	(-62%)	(-69%)	(-56%)
2010 Tier 3*	211.5	211.9	548.4	23.2	25.6	58.6
Change from Base	(-82%)	(-79%)	(-89%)	(-82%)	(-79%)	(-89%)

* = basin data includes a portion of Ventura County in the modeling domain, basinwide levels will be slightly smaller with the exclusion of Ventura County sources.

Since reductions from the baseline are identical for the County to those at the baseline level, the County's share of the basin total is almost the same when calculated either for the baseline of for full AQMP implementation seen as follows:

SAN BERNARDINO COUNTY SHARE OF REGIONAL* POLLUTION BURDEN (%)

Scenario	ROG	NO_x	CO
Existing (199)	9.6	9.2	9.0
2010 Baseline	11.1	11.9	10.8
2010 Tier I	10.1	11.3	11.6
2010 Tier II	12.4	11.3	12.3
2010 Tier III	11.0	12.1	10.7

* = The regional ozone impact modeling grid, including a part of Ventura County outside the AQMP boundary.

The most important conclusions from these data are that there will be a significant increase in San Bernardino County's contribution to the regional burden in response to continued County growth, and that the emissions reductions projected for all County sources identically mirror the reduction expectations for all basinwide sources. County emissions sources have neither been targeted for any unusually aggressive reduction strategies, nor are they expected to lag behind any other portion of the basin. These data do not take into account emissions contributions from County residents in other areas of the basin because of longer commuting patterns associated with jobs/housing imbalance exacerbated by heavy residential growth in western San Bernardino County without corresponding employment growth. County-wide growth is thus not only reflected in the County's share of the regional pollution burden but also to some extent in the overall regional inventory which tends to somewhat reduce the significance of County land use patterns in the overall air quality perspective.

The pattern of projected County growth and associated distribution of point, line and area sources also creates some measurable differences in the anticipated spatial distribution in emissions reductions within the County itself. Table 5 shows that the Chino area, which will benefit markedly from anticipated alternate disposal of agricultural waste (especially cattle manure), will experience a greater reduction of ROGs than the Ontario or San Bernardino areas where anticipated growth and certain stationary sources will continue to create some uncontrollable level of ROGs. The San Bernardino ROG projections include a component from Norton AFB whose closure was not programmed into the AQMP projections made well before the base closure was announced. Such changes are an important reason why an on-going update process needs to be undertaken to incorporate any such changes and to track the progress of the various AQMP measures in terms of effectiveness and implementation schedule.

Table 5 shows that future ozone precursor emissions will continue to be concentrated in the Ontario and San Bernardino "hot spots," but with significantly reduced levels. The ultimate anticipated replacement of the fossil-fueled internal combustion engine as the prime mover of all transportation sources will accentuate the role of aircraft sources which will likely not be amenable to full control, and those industrial sources using reactive materials or using fossil-fueled energy sources. Until that replacement occurs, however, mobile source emissions reduction strategies must be the major emphasis in any effective pollution control program, especially through any discretionary actions influenced by implementation of an air quality element. Table 5 shows that there is no single community that uniquely has a large uncontrolled emissions excess. Table 5 also shows that even small emissions reductions will become critical as the overall emissions burden becomes progressively smaller. For example, 100 pounds of ROG (the amount of ROG released if one full tank of gasoline were left to evaporate) represents the following fraction of community-wide daily emissions at total AQMP implementation:

Chino	-	16%	Fontana	-	11%
Ontario	-	3%	Colton	-	9%
Upland	-	6%	San Bernardino	-	3%
Rancho Cucamonga	-	10%	Redlands	-	14%

Quite obviously, very small emissions reductions beyond those projected by full AQMP implementation will have a measurable impact on any one community's contribution to the overall emissions burden. A continuing awareness at the local level of the air emissions originating within a given jurisdiction is, therefore, important. These data are public information, and should be included in any progress tracking requirements of an air quality element. To a large extent, unhealthful air quality in San Bernardino County is due to imported pollution, exacerbated by exported travel because of jobs/housing imbalance. The AQMP implementation emissions data show, however, that any positive emissions reduction steps that can be taken at the local level beyond those mandated in the AQMP can have a very substantial effect on future air quality as even the smallest reduction increments become larger and larger fractions of the regional emissions distribution.

TABLE 5

COMMUNITY OZONE PRECURSOR EMISSIONS REDUCTION TARGETS
(Emissions in tons/day/25 km² grid cell covering the community)

Community	Existing	2010 Base	2010 Tier I	Δ	2010 Tier II	Δ	2010 Tier III	Δ
Reactive Organic Gases								
Chino	3.53	3.36	0.98	(-72%)	0.60	(-82%)	0.32	(-90%)
Ontario	4.80	6.74	3.17	(-53%)	2.16	(-68%)	1.60	(-76%)
Upland	4.44	4.82	2.14	(-56%)	1.36	(-72%)	0.81	(-83%)
Rancho Cucamonga	1.56	2.96	1.61	(-46%)	0.97	(-67%)	0.51	(-83%)
Fontana	1.29	1.93	1.19	(-38%)	0.75	(-65%)	0.45	(-77%)
Colton	2.72	2.52	1.39	(-45%)	0.93	(-63%)	0.53	(-79%)
San Bernardino	6.32	6.40	3.58	(-44%)	2.61	(-59%)	1.83	(-71%)
Redlands	2.75	2.18	1.26	(-42%)	0.77	(-65%)	0.37	(-82%)
County Average				(-48%)		(-62%)		(-82%)
Nitrogen Oxides								
Chino	1.07	1.59	0.70	(-56%)	0.46	(-71%)	0.28	(-82%)
Ontario	3.81	6.83	2.41	(-65%)	1.58	(-77%)	1.04	(-85%)
Upland	3.80	5.26	2.08	(-60%)	1.47	(-72%)	0.99	(-81%)
Rancho Cucamonga	1.33	3.22	1.29	(-60%)	0.80	(-75%)	0.50	(-84%)
Fontana	3.89	5.45	2.06	(-62%)	1.49	(-73%)	1.27	(-77%)
Colton	3.31	3.26	1.69	(-48%)	1.01	(-69%)	0.49	(-85%)
San Bernardino	5.24	7.41	4.37	(-41%)	2.71	(-63%)	2.03	(-73%)
Redlands	1.84	1.81	0.96	(-47%)	0.60	(-67%)	0.29	(-84%)
County Average				(-54%)		(-69%)		(-79%)

Δ = percentage from "no AQMP" baseline

IV. AIR QUALITY PRIORITIES FOR SAN BERNARDINO

Air quality ignores jurisdictional boundaries, consequently air quality must be tackled on a regional basis. However, this does not preclude tailoring solutions to the problem based on local circumstances. This is certainly the case in the San Bernardino portion of the South Coast Air Basin (SOCAB).

Air quality in the basin as a whole is characterized by high levels of Ozone (O3), Carbon Monoxide (CO), Nitrogen Dioxide (NO2) and 10-micron diameter respirable particulate matter (PM-10). San Bernardino County, which has some of the worst "smog" episodes in the country is in attainment with national standards for two of those four criteria pollutants, CO and NO2.

To improve air quality in San Bernardino, local government should set its highest priority on reducing Ozone, and next highest on reducing particulate matter (PM10).

San Bernardino County is responsible for less than ten percent of basin emissions. And even in future years when the growth in the County outpaces the growth in western counties, the county's proportionate share of total emissions will be small. The source areas for the two pollutants impacting the county the most, especially ozone, but also PM10, lie to the west. However, the county is not entirely defenseless.

The county's residents commute by the tens of thousands to employment sites in Los Angeles and Orange counties, most of their emissions being measured in those counties rather than in their "home" county. They travel and release pollutants into an emission's plume which travels eastward during the "smog" season and hits San Bernardino County during the late morning and afternoon. One of the most important things that San Bernardino County's local governments can do is to provide employment opportunities for their residents. Minimizing the commute distance will, obviously, reduce vehicle miles travelled (VMT), but perhaps more importantly, will make alternative modes of transportation more viable.

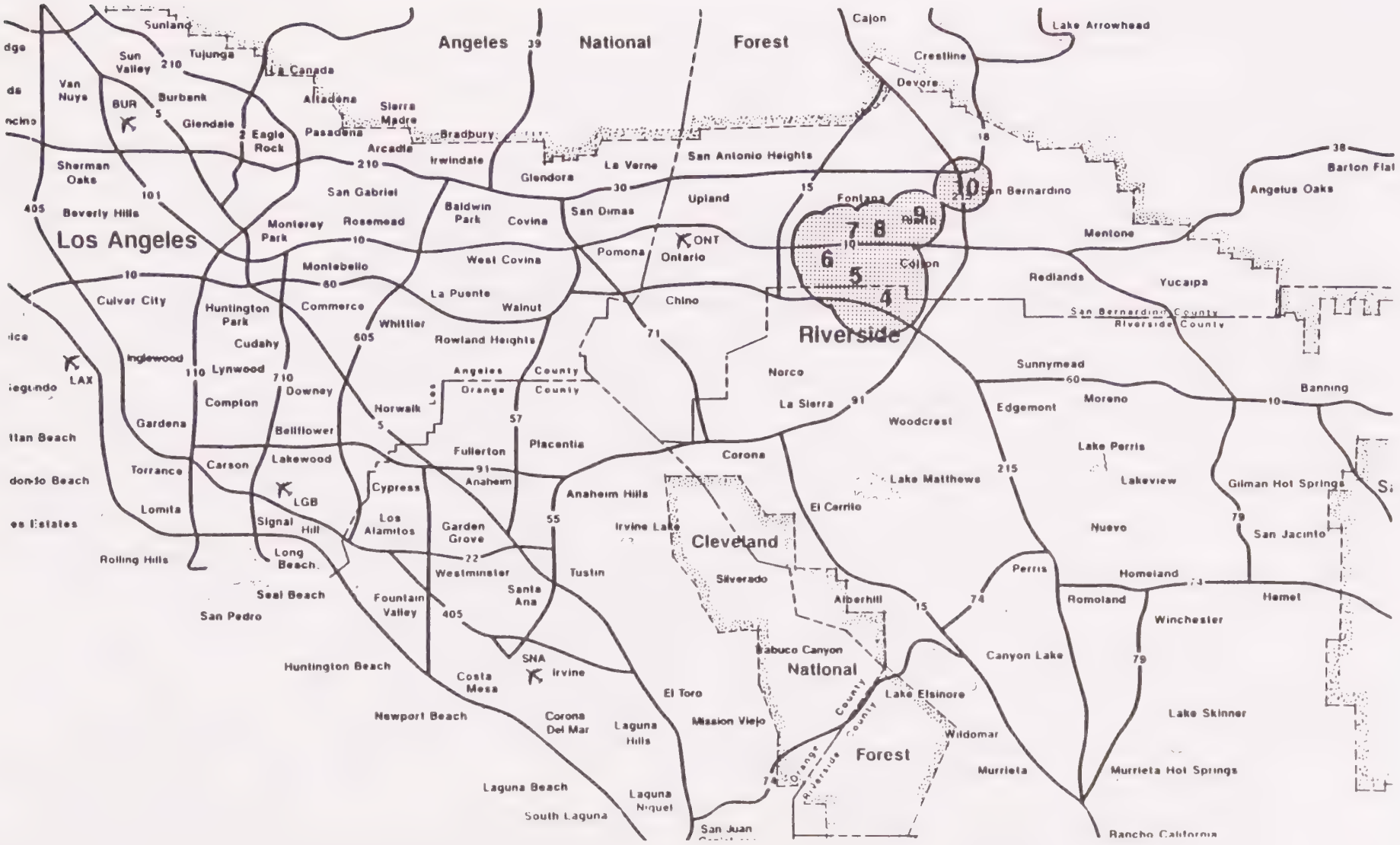
Much like Orange and Los Angeles, San Bernardino County is also a source area. This is especially evident during the winter months when local emissions of NO2 and CO travel westward, helping to create unhealthful levels of these criteria pollutants in Los Angeles and Orange Counties. Despite San Bernardino being in attainment for these pollutants, San Bernardino's local governments should work towards reducing CO and NO2 emissions: as an example to western counties; because controlling CO and NO2 will also help control precursors to Ozone formation during the "smog" season; and because the air quality problem requires every local government to do whatever it can to reduce emissions.

San Bernardino County's air pollution problem is largely a result of emissions from western counties. Despite lack of direct control over much of the pollution problem, San Bernardino still has a significant role to play in bringing the basin into compliance with State and Federal air quality standards. It is up to local government in San Bernardino County to make the most of the tools at its disposal, and the Regional Air Quality Plan is a start in the right direction.

APPENDIX A

Source Area Maps for Air Arriving in Ontario and San Bernardino at 10 a.m., Noon, 2, 4 and 6 p.m. in July.

(Numbering reflects prior time at which an air parcel was at a given location, expanded circle size from prior hours indicates progressive uncertainty in its exact previous location.)



SAN BERNARDINO 10:00 A.M.



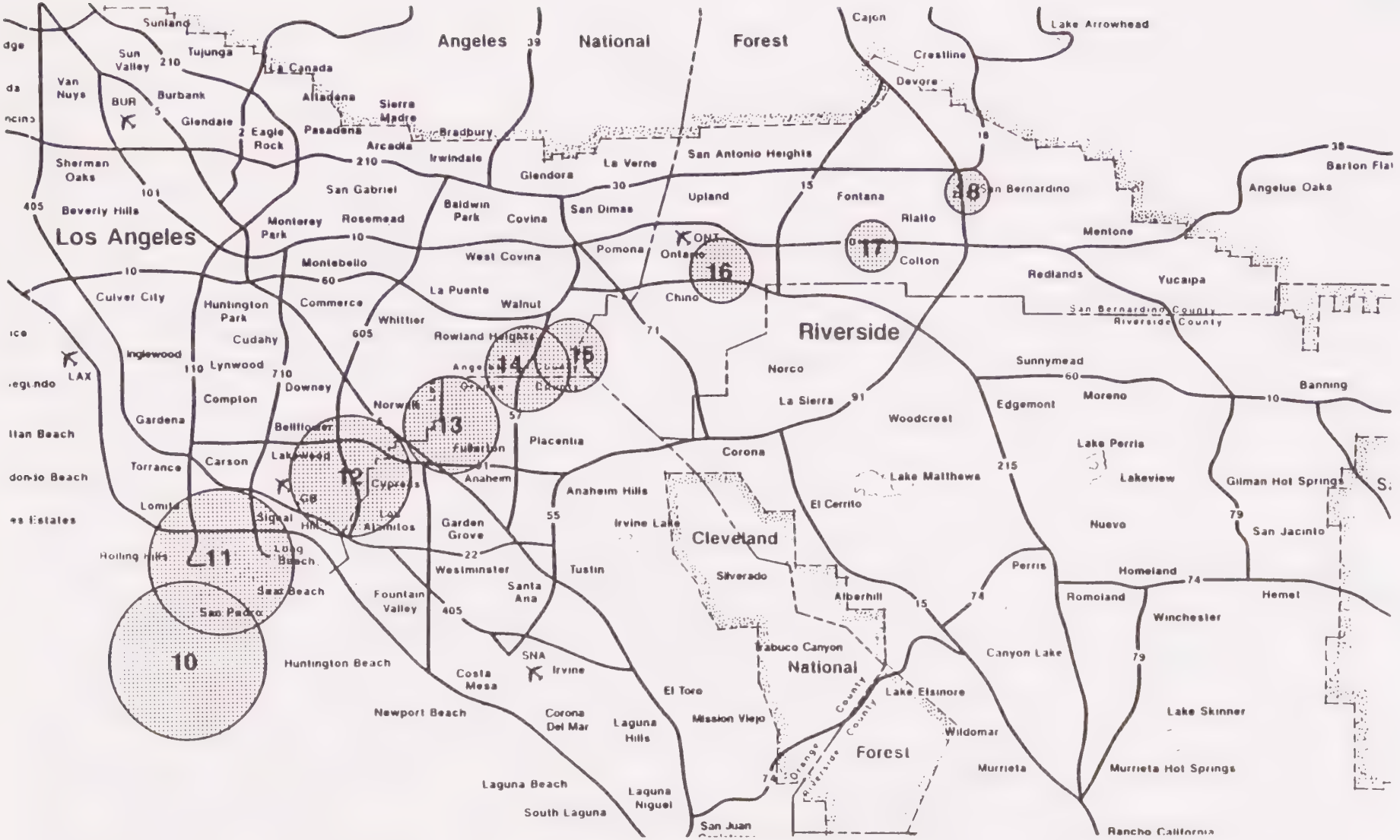
SAN BERNARDINO 12:00 P.M.



SAN BERNARDINO 2:00 P.M.



SAN BERNARDINO 4:00 P.M.



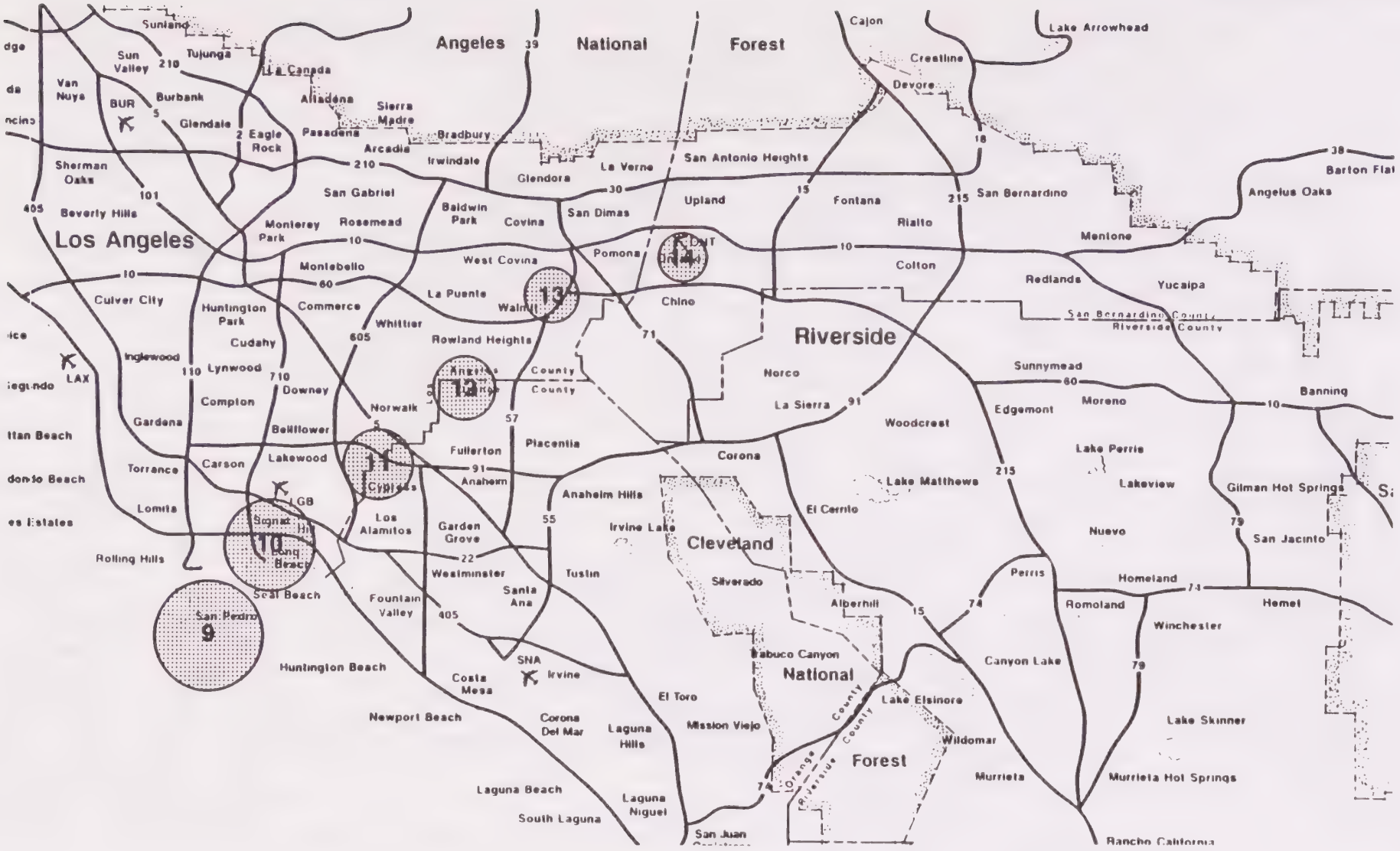
SAN BERNARDINO 6:00 P.M.



ONTARIO 10:00 A.M.



ONTARIO 12:00 P.M.



ONTARIO 2:00 P.M.



ONTARIO 4:00 P.M.



ONTARIO 6:00 P.M.

APPENDIX B

County and Basinwide Emissions Distributions

-1985 AQMD Inventory

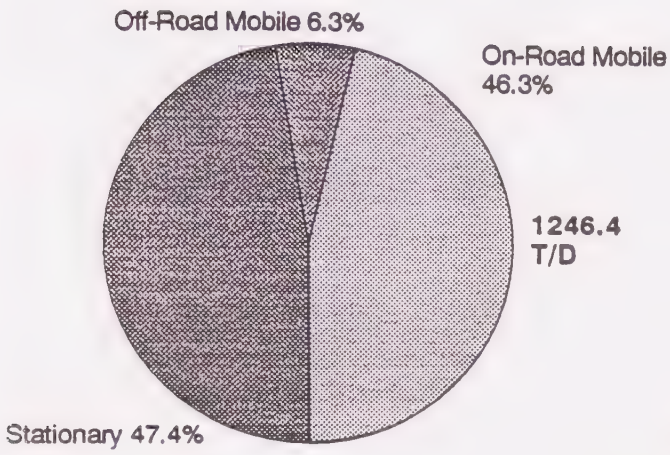
-1990 Interpolation

-2000, 2010 Baseline Projections (no 1989 AQMP)

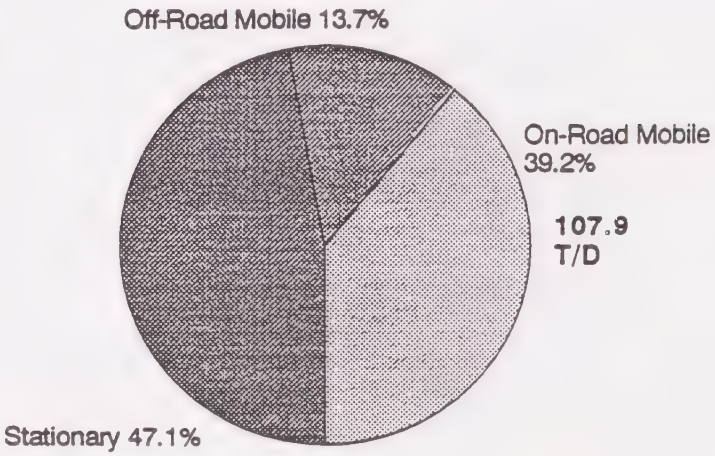
ROG, NOx, CO and PM-10 (tons/day)

ROG EMISSIONS 1985

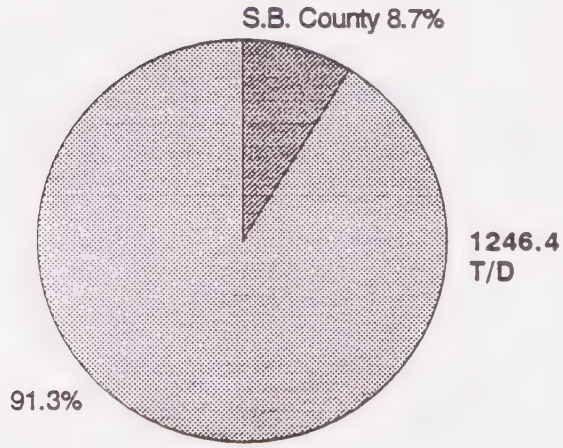
BASINWIDE



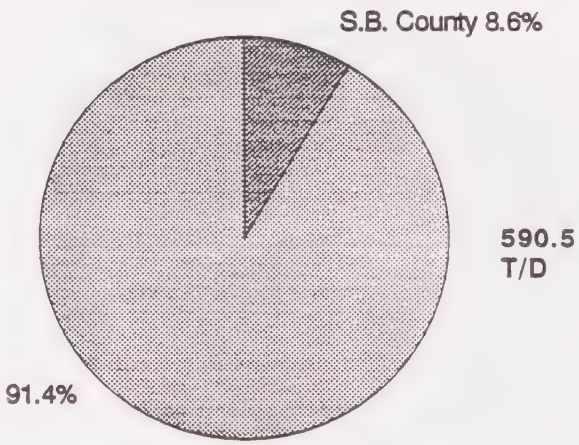
S.B. COUNTY



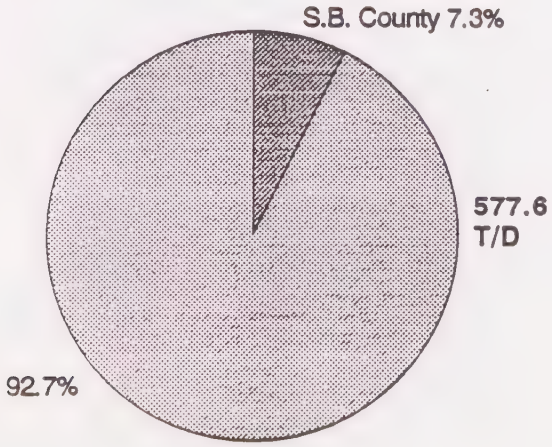
BASIN SHARE



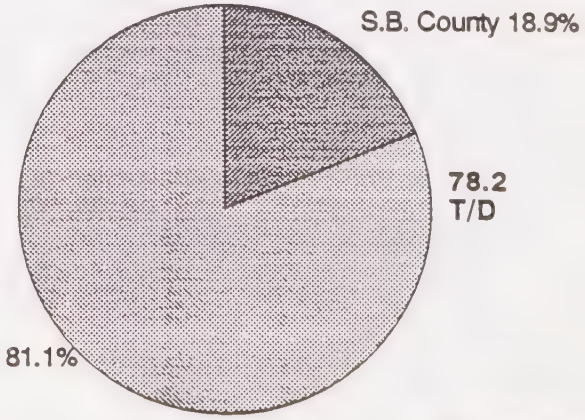
STATIONARY SOURCES



ON-ROAD MOBILE SOURCES



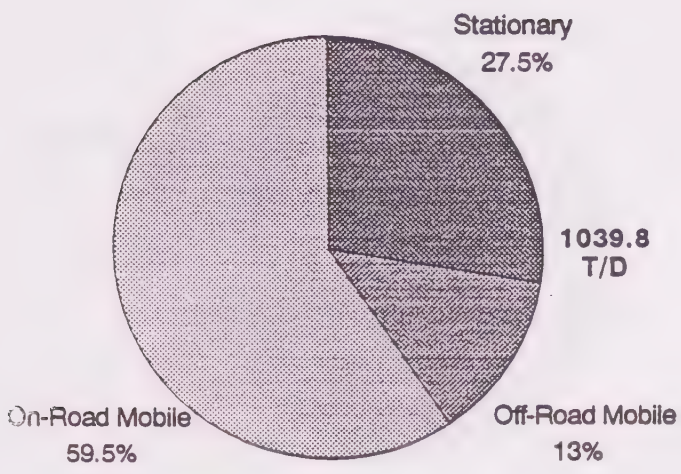
OFF-ROAD MOBILE SOURCES



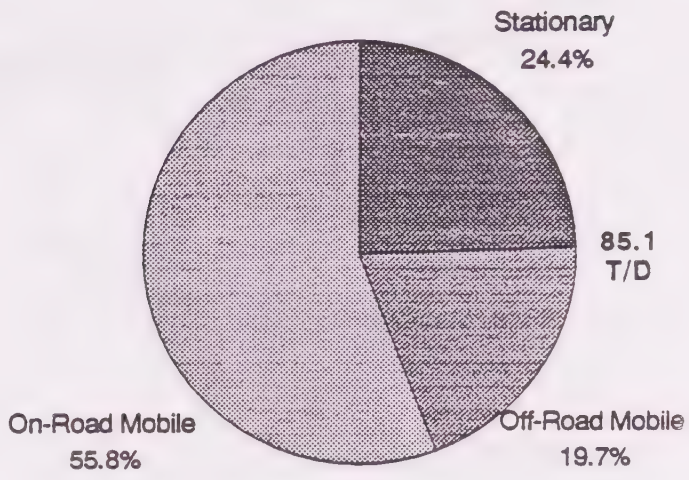
SBC-04\ROG-1985.GEM

NOX EMISSIONS 1985

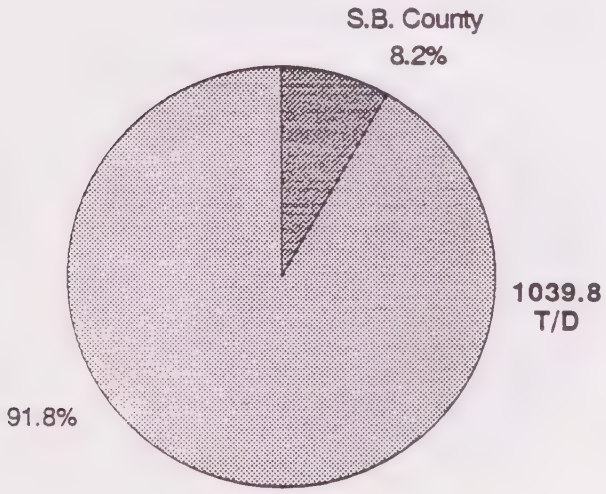
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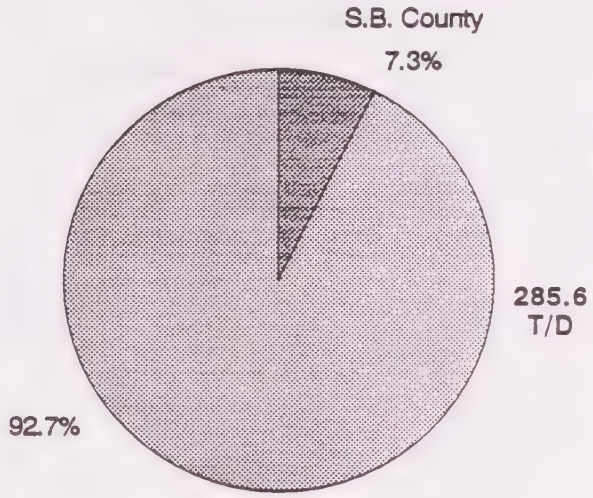
S.B. COUNTY



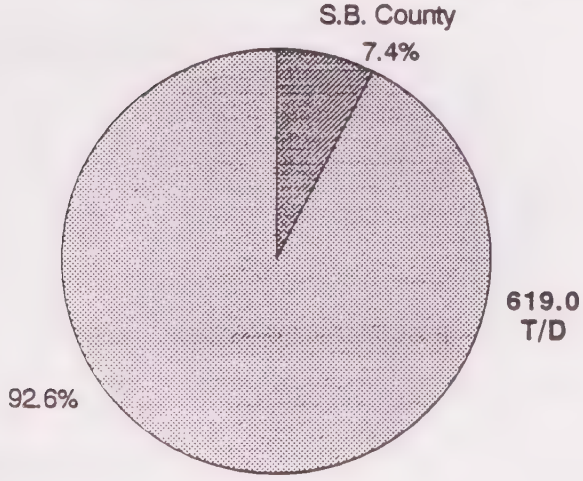
BASIN SHARE



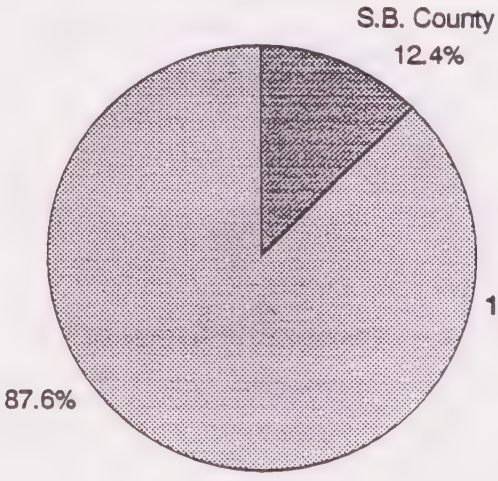
STATIONARY SOURCES



ON-ROAD MOBILE SOURCES



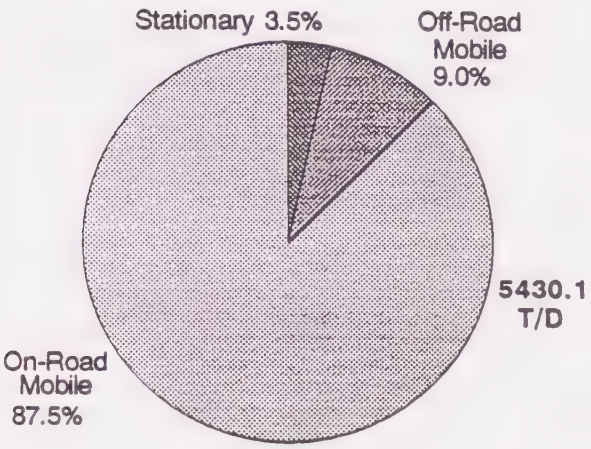
OFF-ROAD MOBILE SOURCES



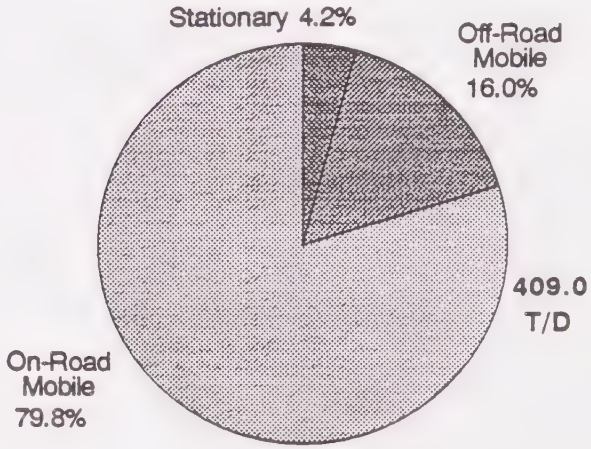
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CO EMISSIONS 1985

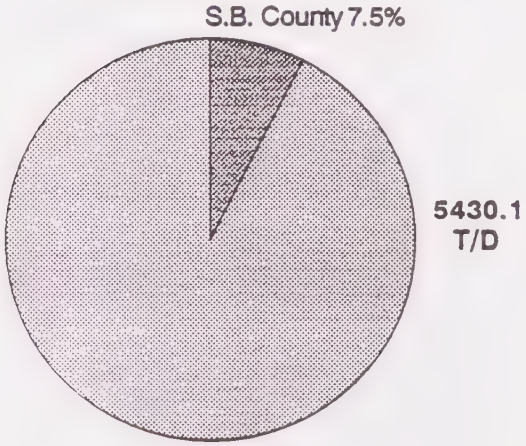
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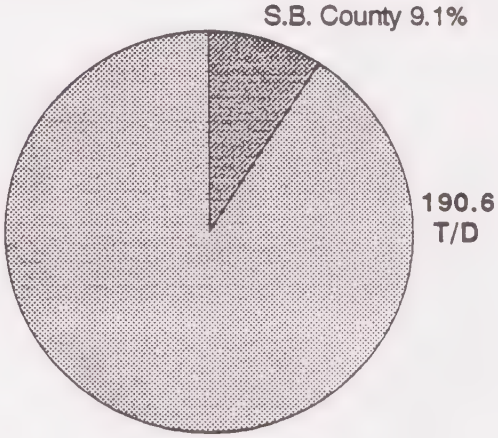
S.B. COUNTY



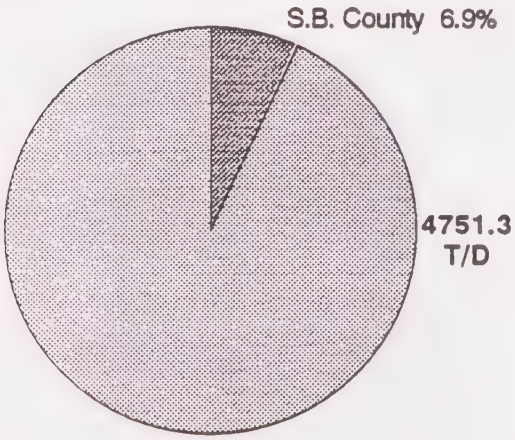
BASIN SHARE



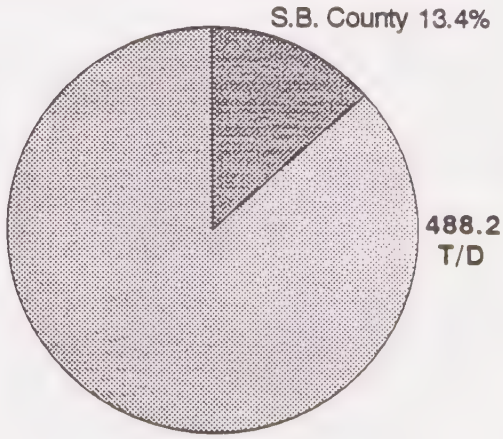
STATIONARY SOURCES



ON-ROAD MOBILE SOURCES

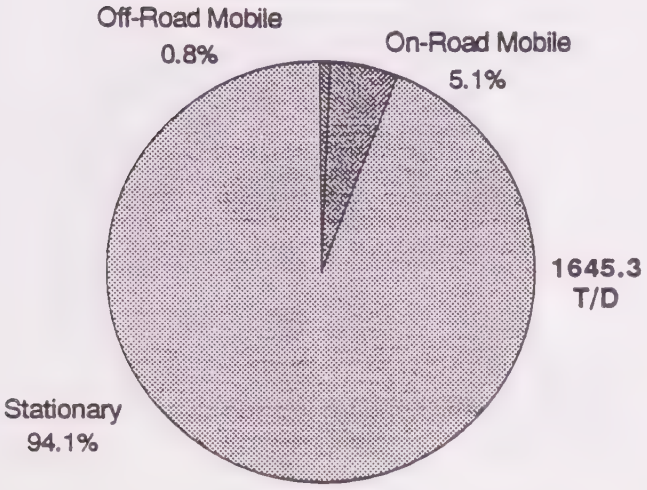


OFF-ROAD MOBILE SOURCES

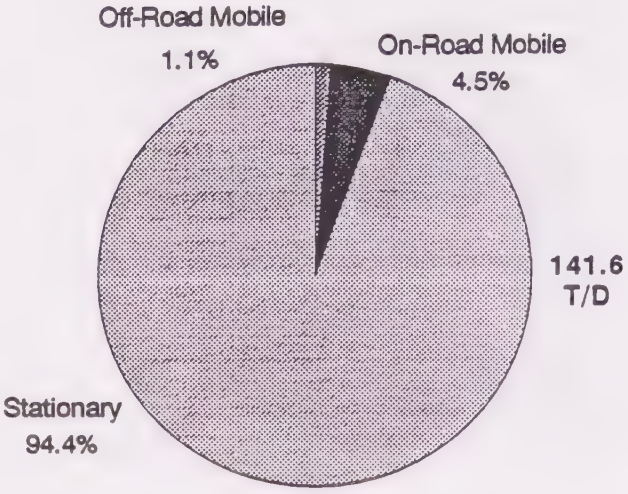


PM-10 EMISSIONS 1985

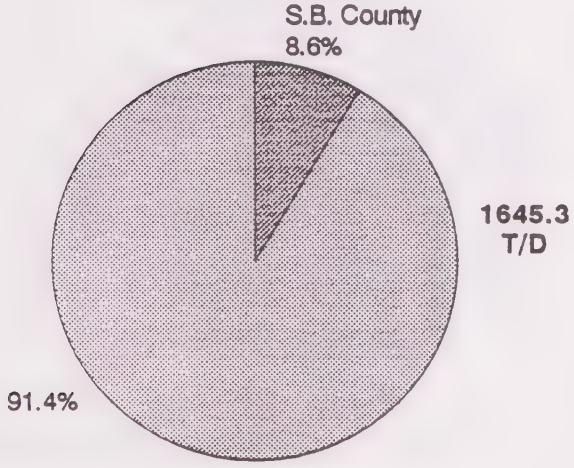
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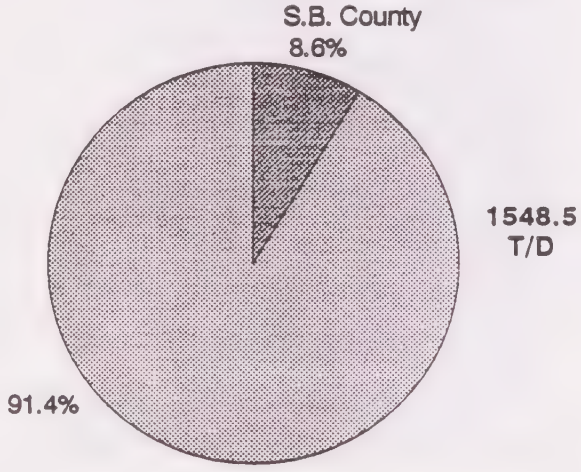
S.B. COUNTY



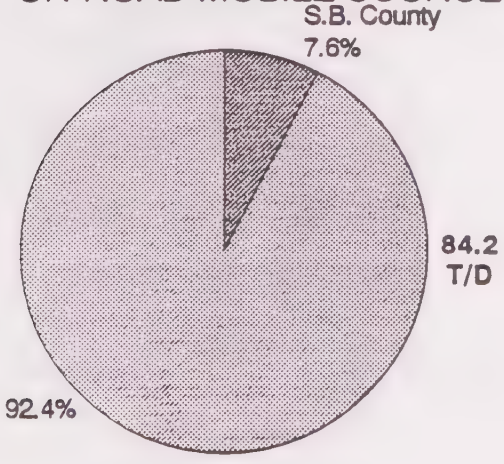
BASIN SHARE



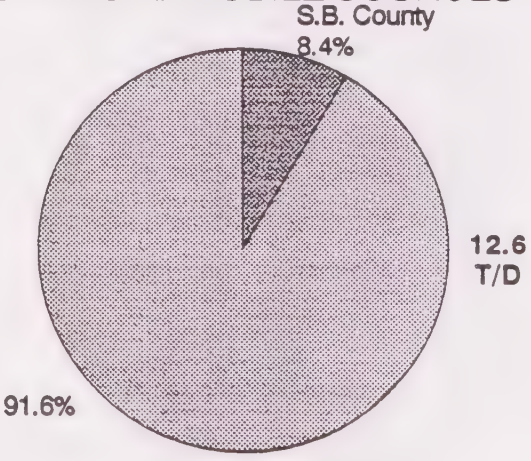
STATIONARY SOURCES



ON-ROAD MOBILE SOURCES



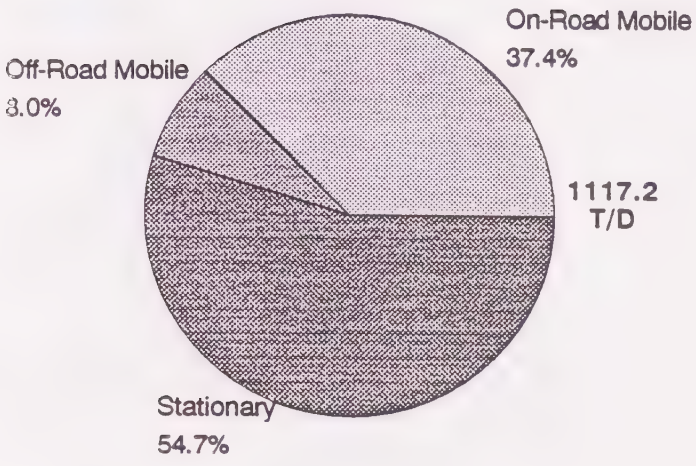
OFF-ROAD MOBILE SOURCES



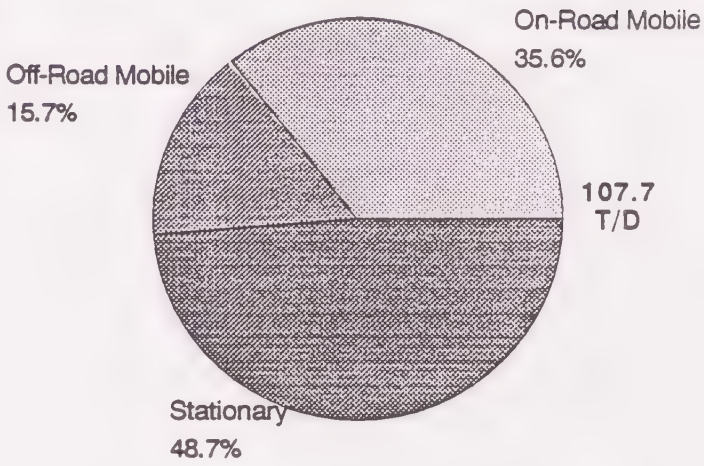
SBC-04\PM-1985.GEM

ROG EMISSIONS 1990

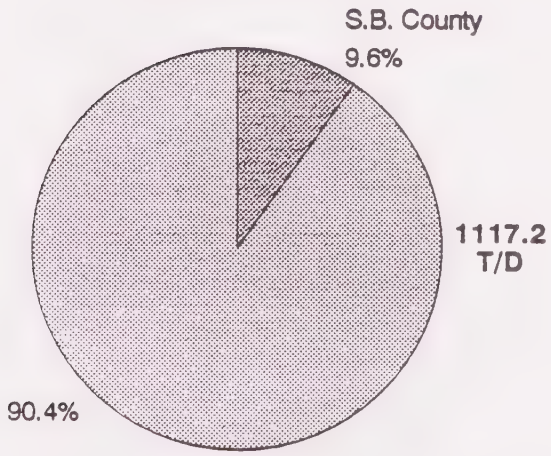
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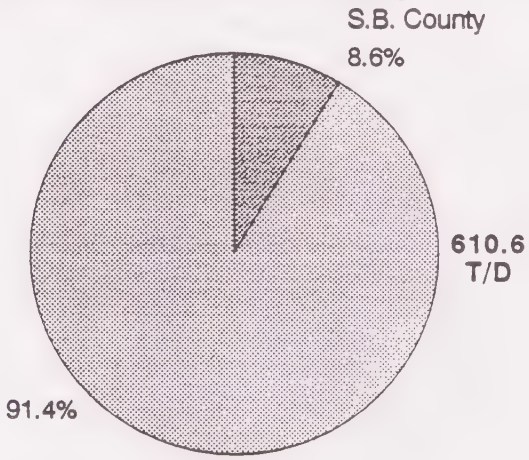
S.B. COUNTY



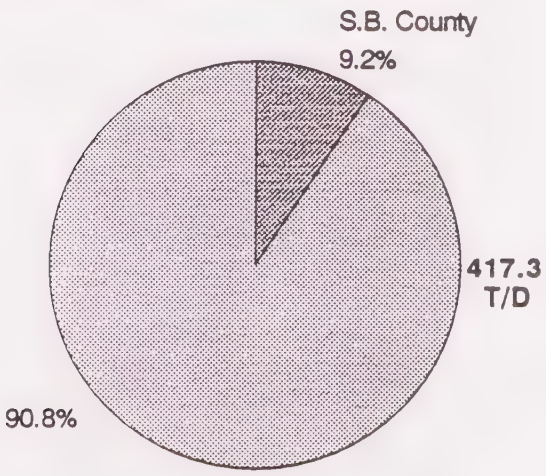
BASIN SHARE



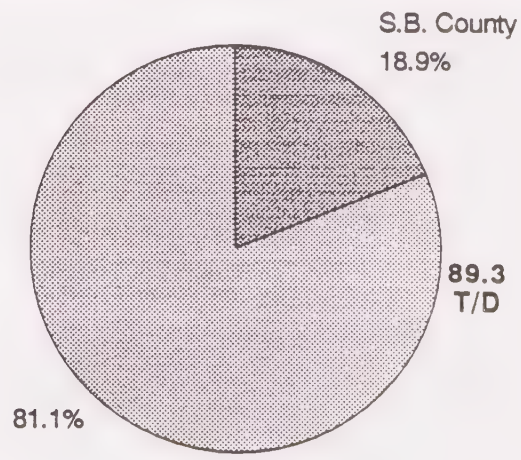
STATIONARY SOURCES



ON-ROAD MOBILE SOURCES

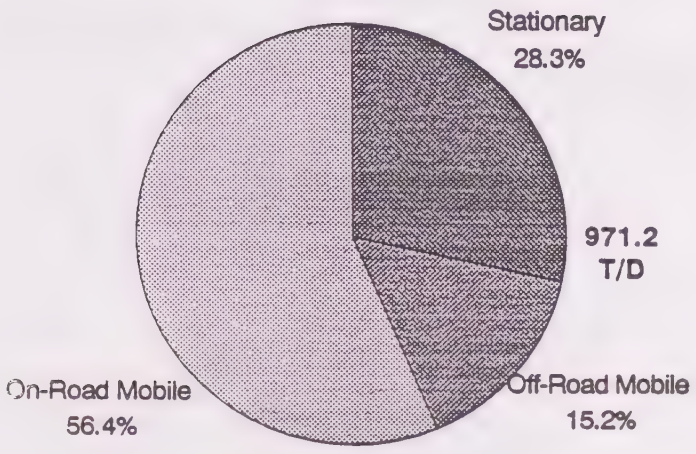


OFF-ROAD MOBILE SOURCES

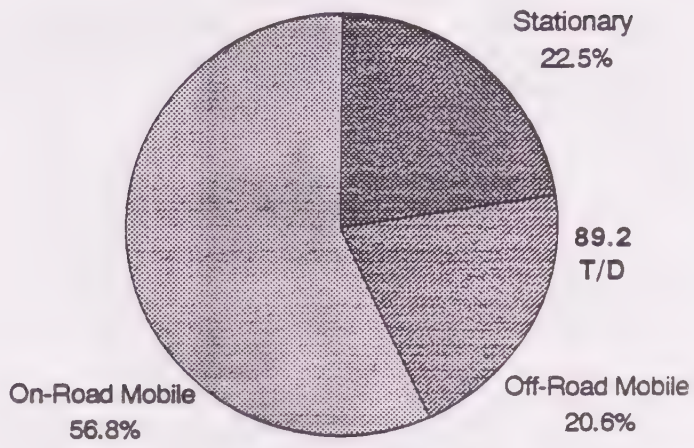


NOX EMISSIONS 1990

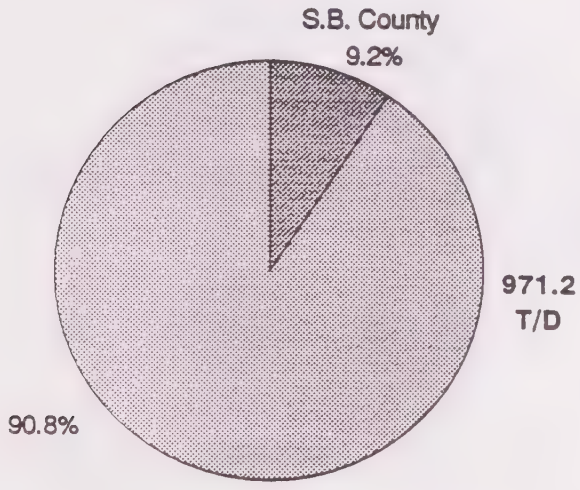
BASINWIDE



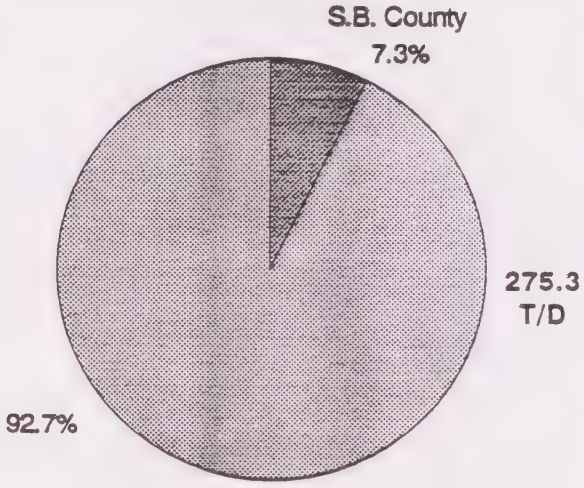
S.B. COUNTY



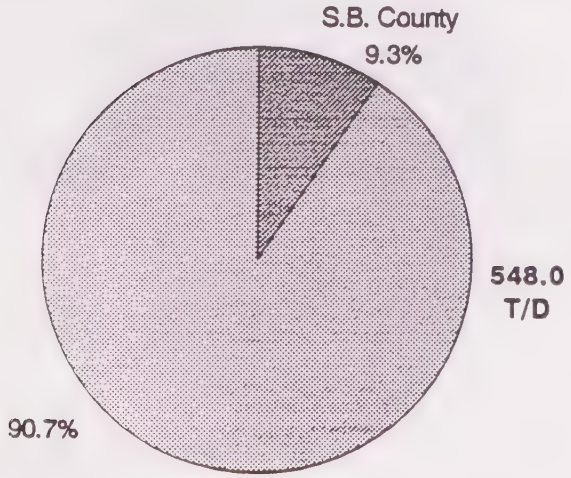
BASIN SHARE



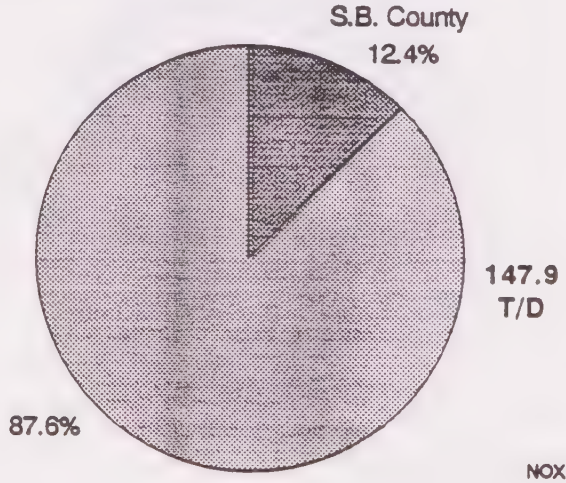
STATIONARY SOURCES



ON-ROAD MOBILE SOURCES



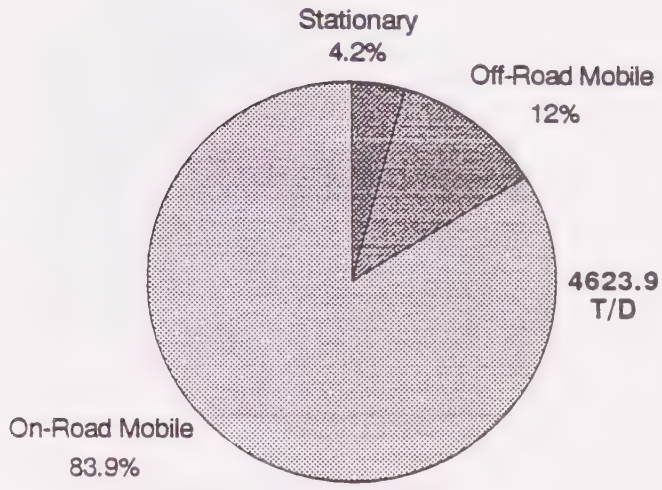
OFF-ROAD MOBILE SOURCES



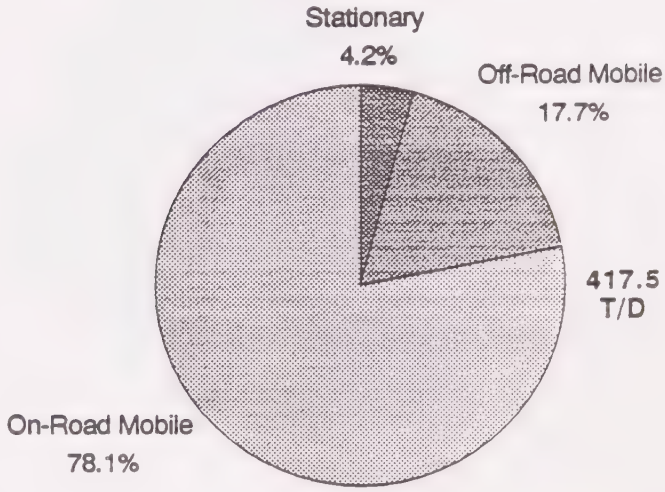
NOX-90.GEM

CO EMISSIONS 1990

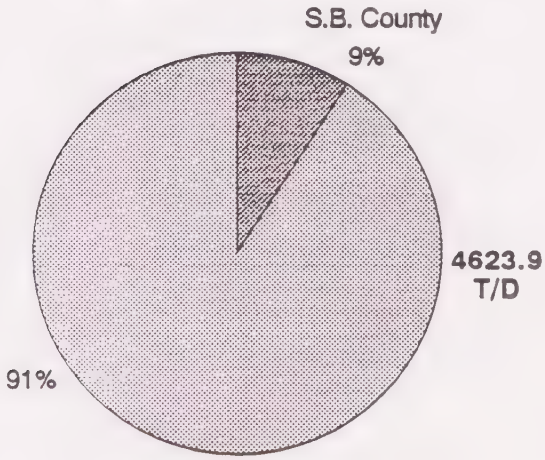
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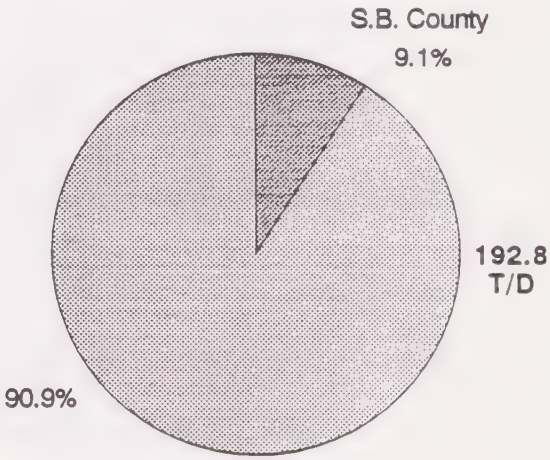
S.B. COUNTY



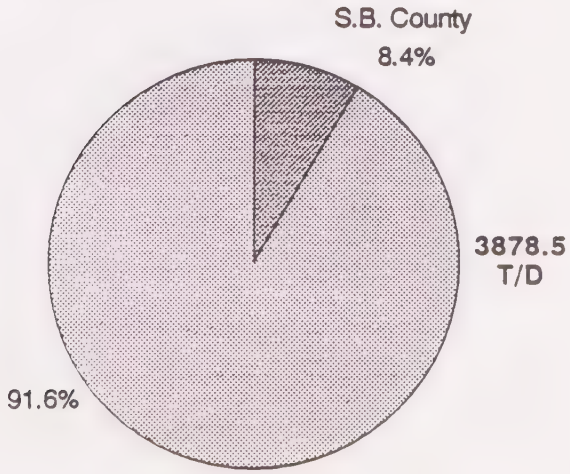
BASIN SHARE



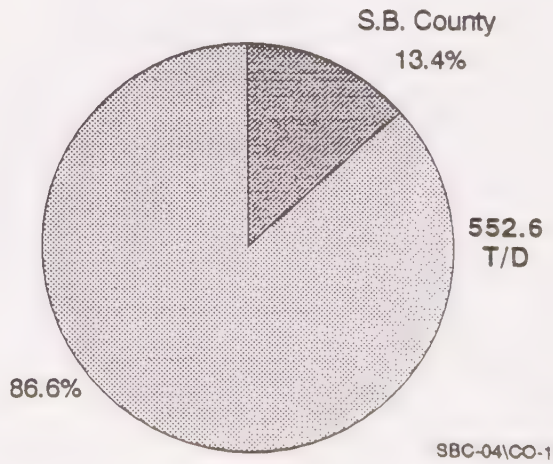
STATIONARY SOURCES



ON-ROAD MOBILE SOURCES



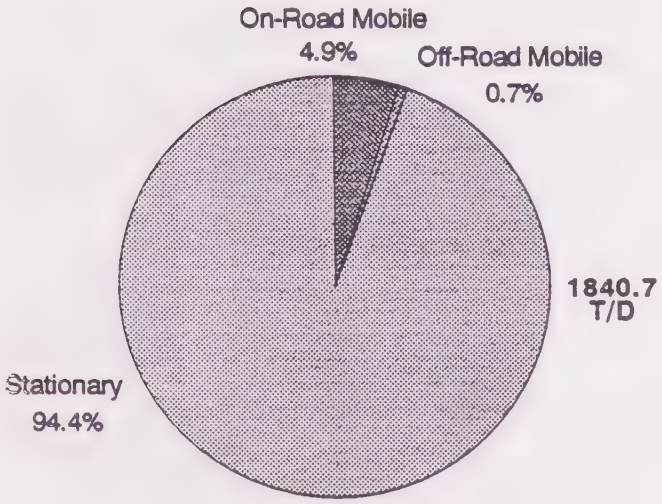
OFF-ROAD MOBILE SOURCES



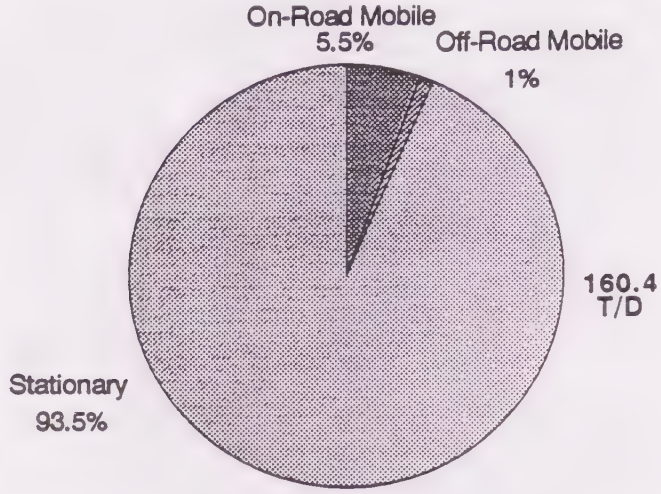
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PM-10 EMISSIONS 1990

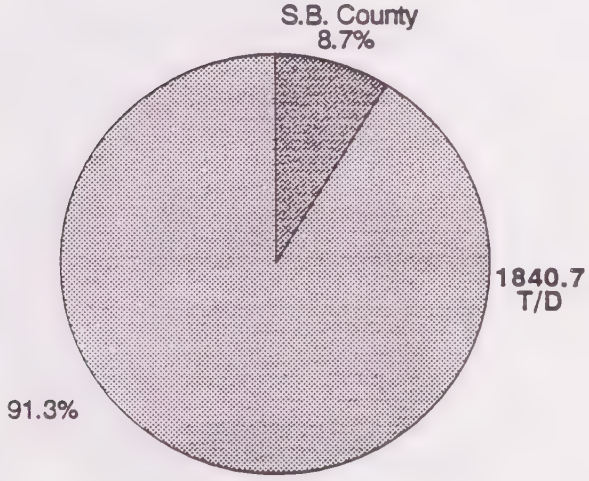
BASINWIDE



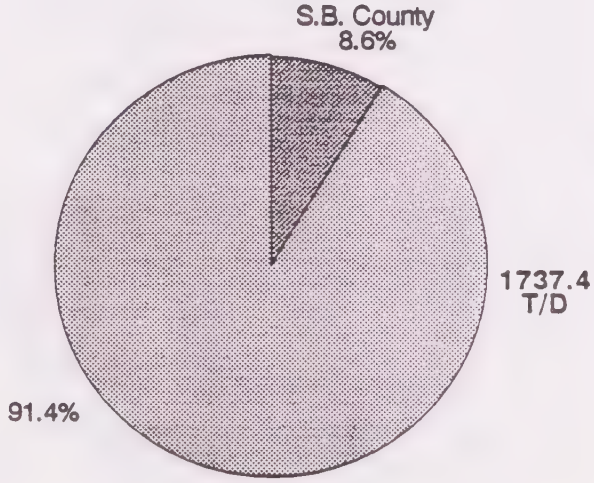
S.B. COUNTY



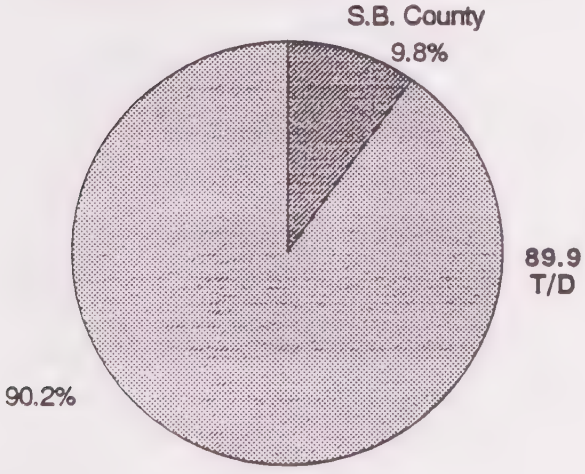
BASIN SHARE



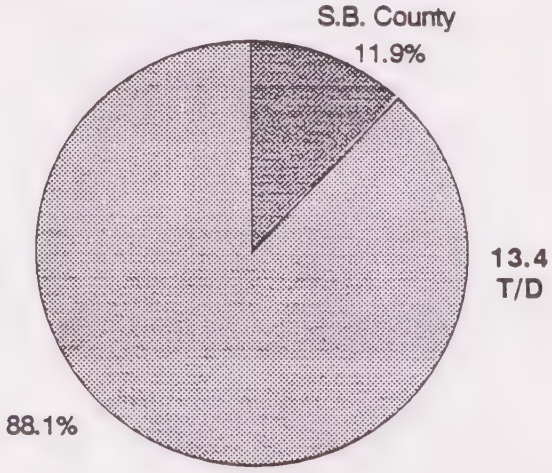
STATIONARY SOURCES



ON-ROAD MOBILE SOURCES



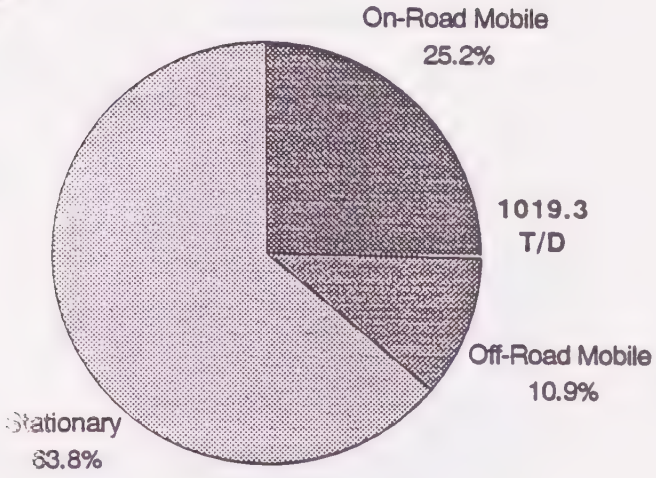
OFF-ROAD MOBILE SOURCES



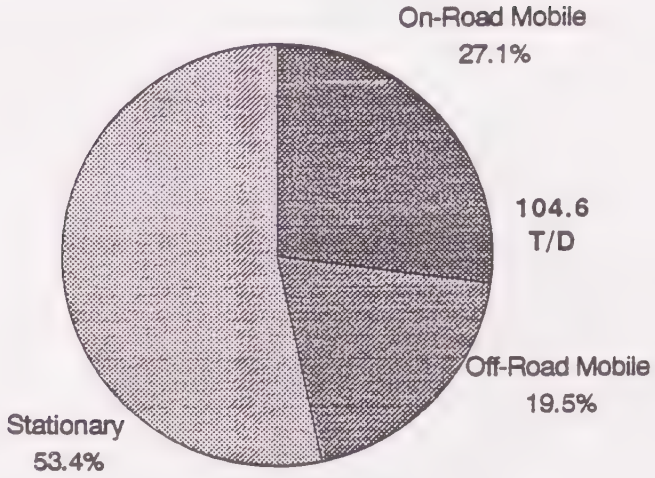
PM1990.GEM

ROG EMISSIONS 2000

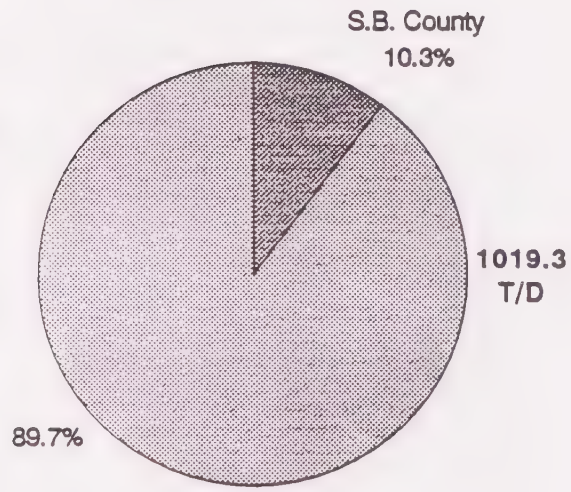
BASINWIDE



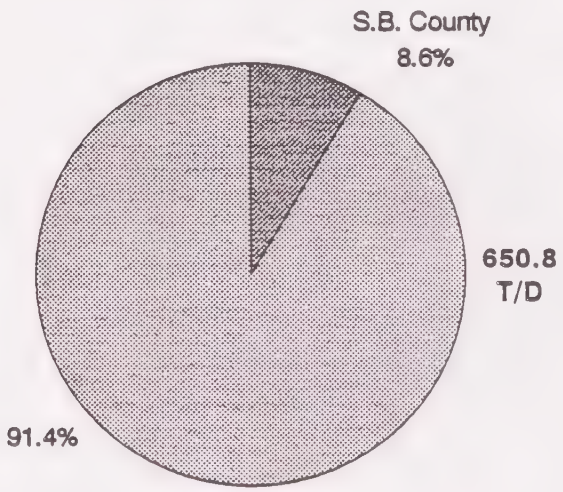
S.B. COUNTY



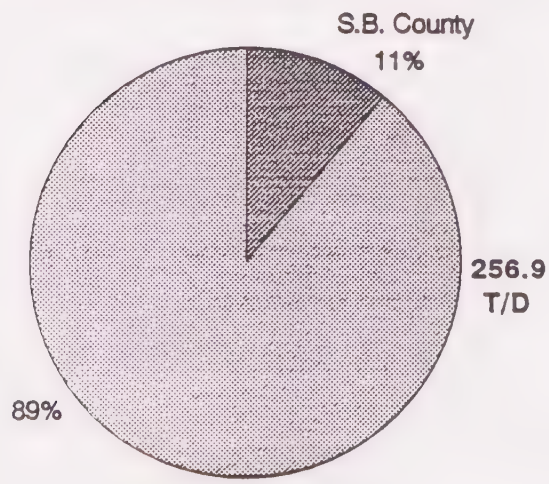
BASIN SHARE



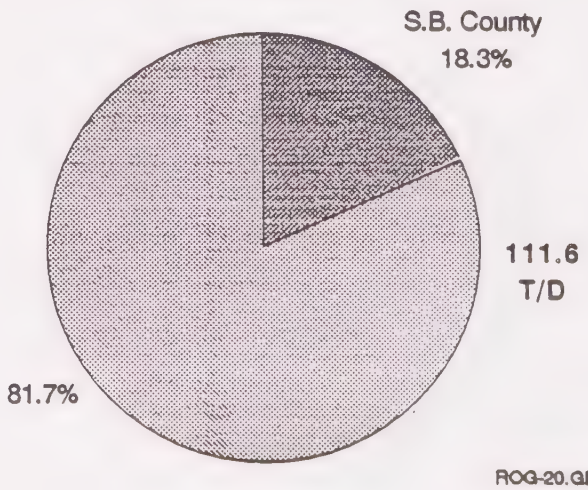
STATIONARY SOURCES



ON-ROAD MOBILE SOURCES



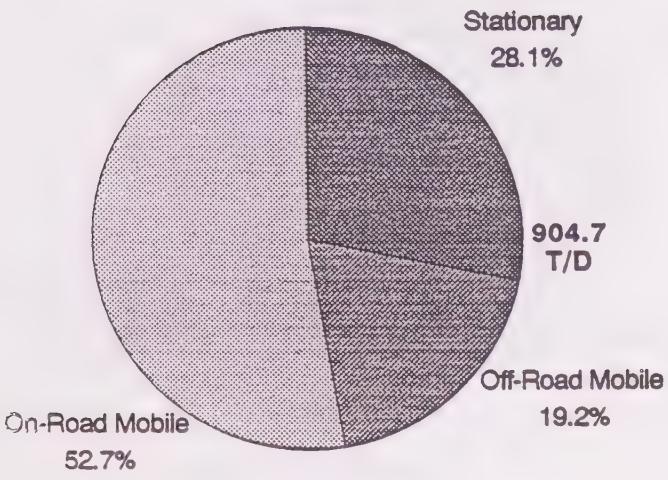
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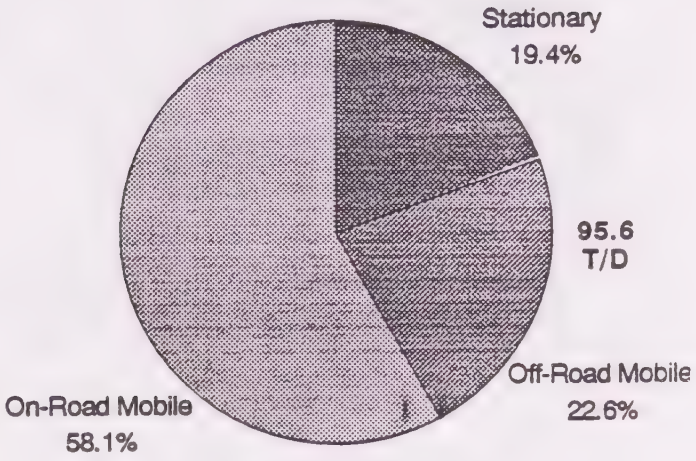
ROG-20.GEM

NOX EMISSIONS 2000

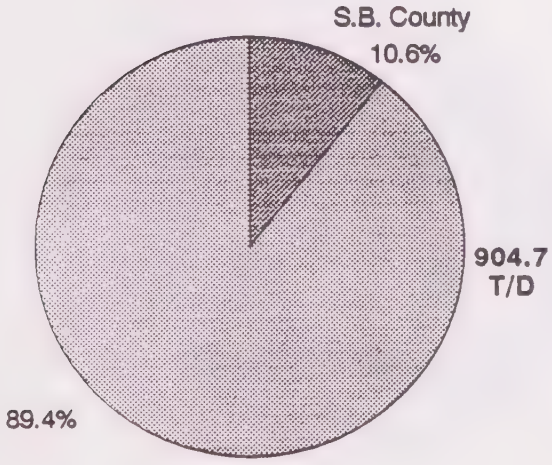
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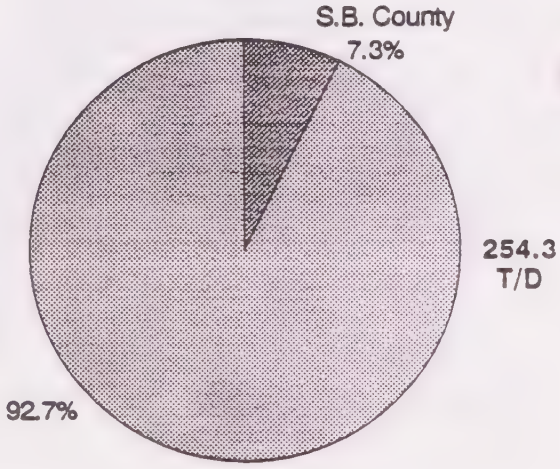
S.B. COUNTY



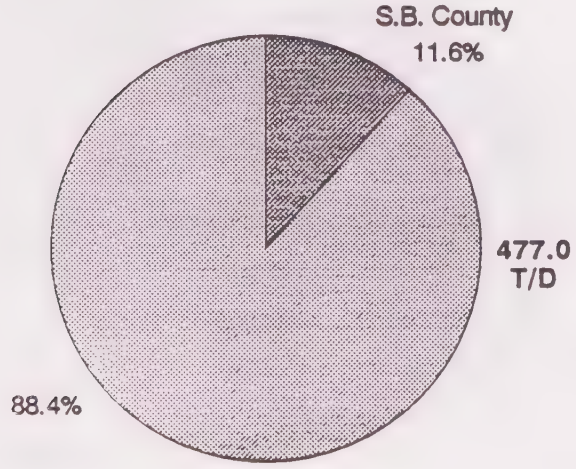
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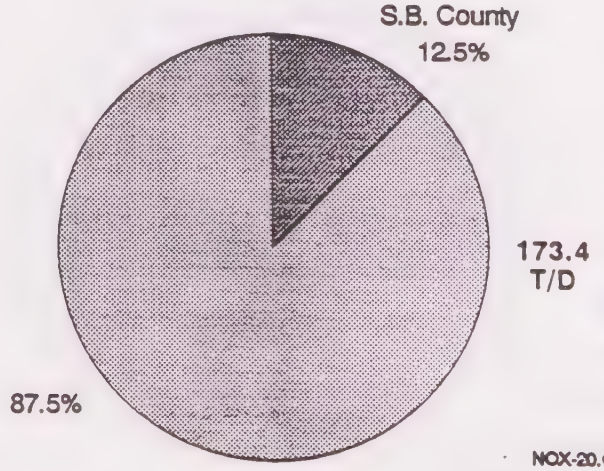
STATIONARY SOURCES



ON-ROAD MOBILE SOURCES



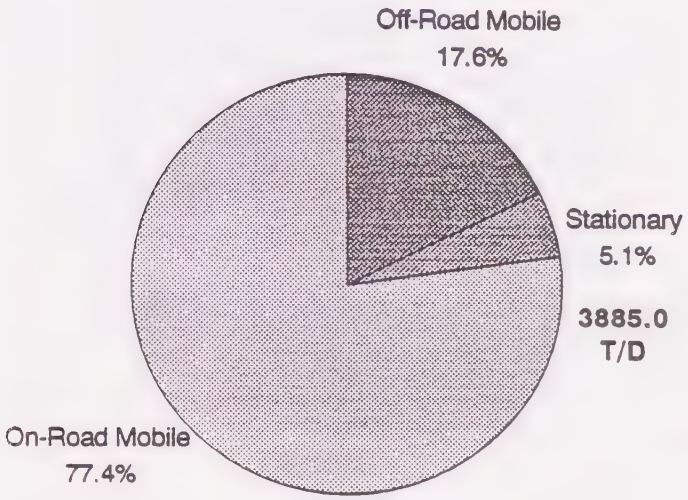
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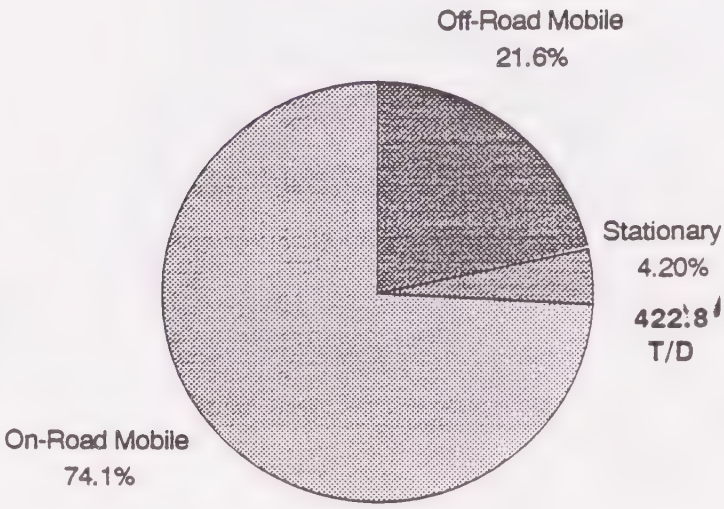
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CO EMISSIONS 2000

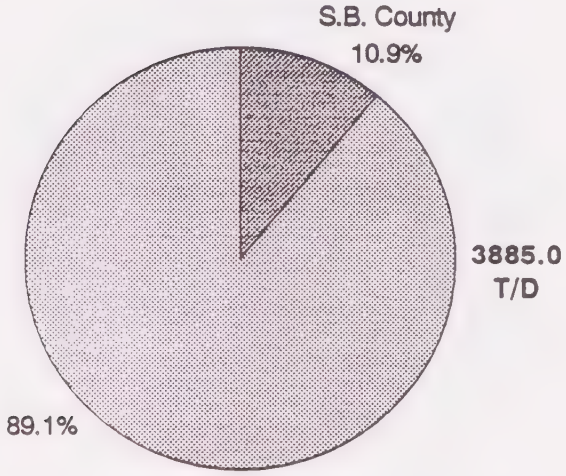
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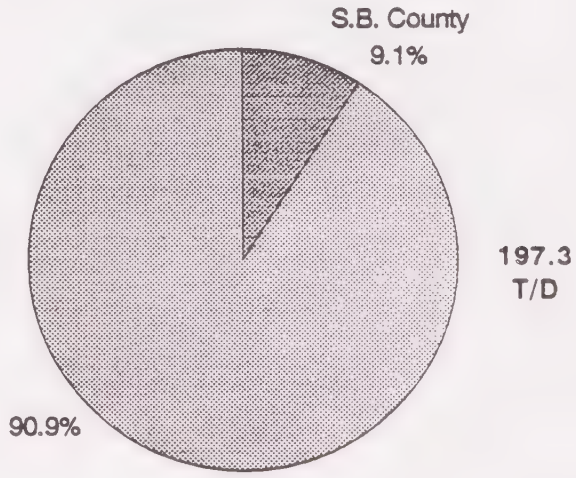
S.B. COUNTY



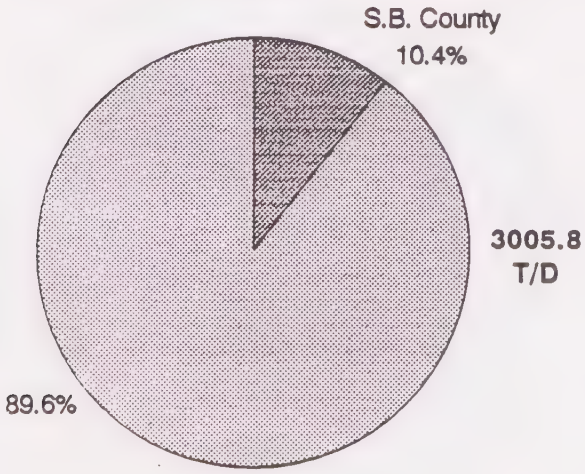
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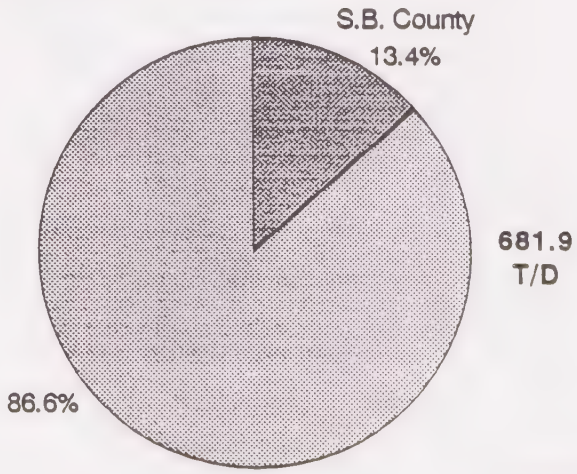
STATIONARY SOURCES



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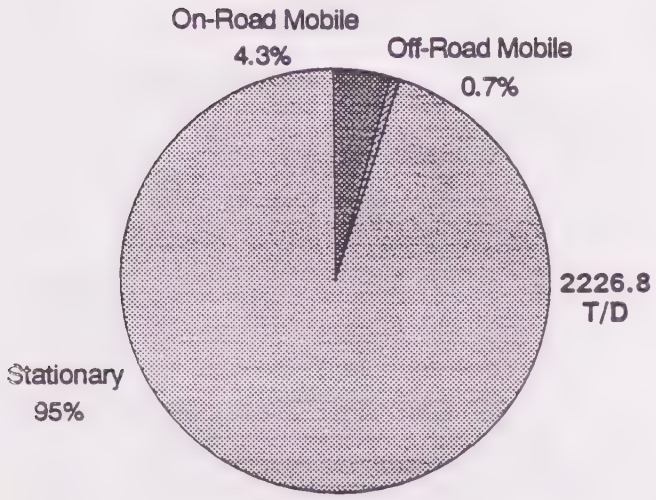
OFF-ROAD MOBILE SOURCES



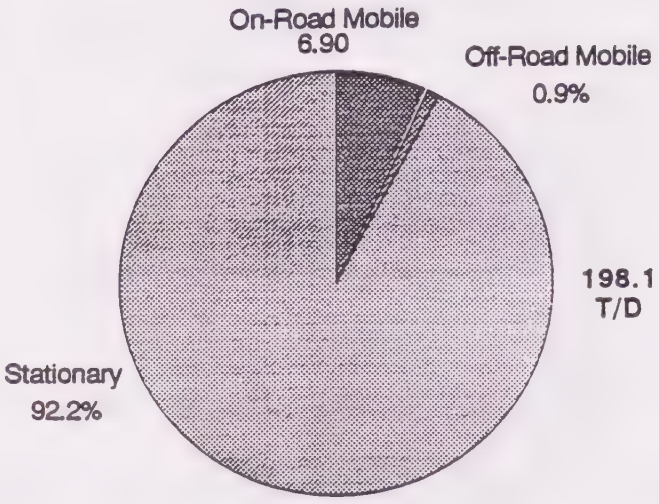
CO2000.GEM

PM-10 EMISSIONS 2000

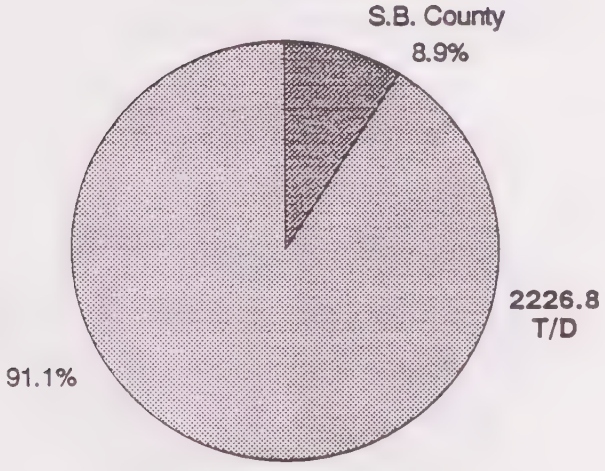
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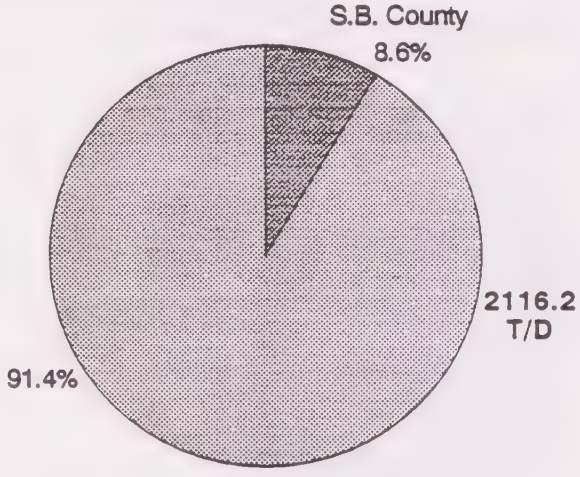
S.B. COUNTY



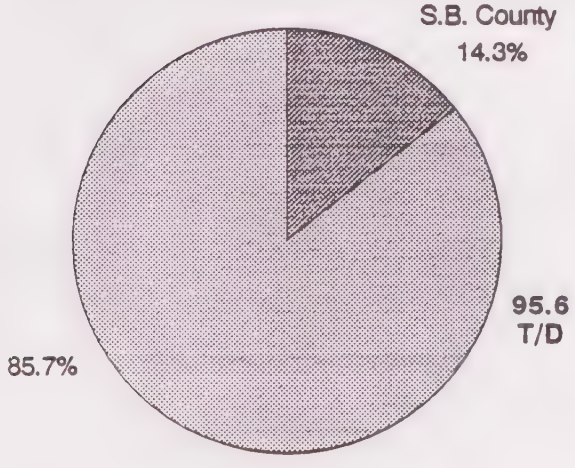
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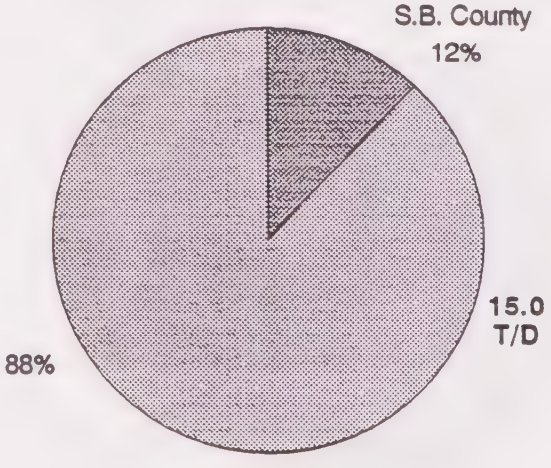
STATIONARY SOURCES



ON-ROAD MOBILE SOURCES



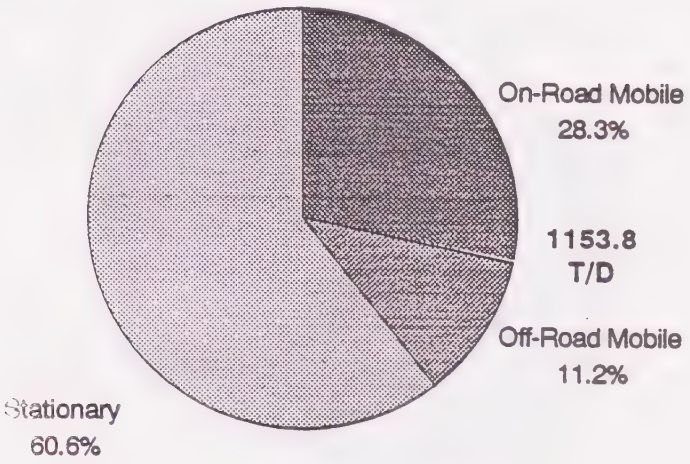
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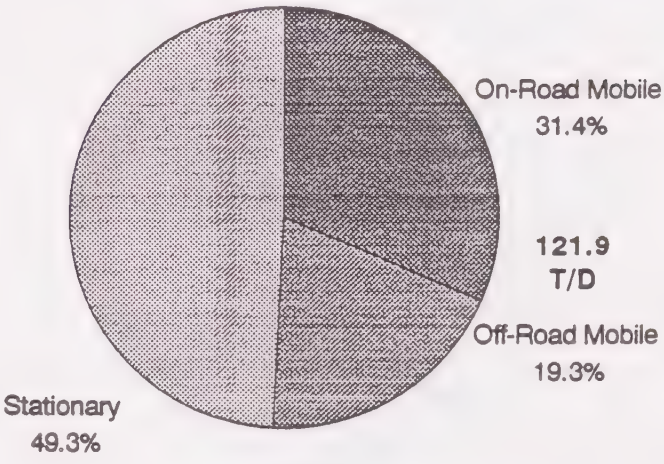
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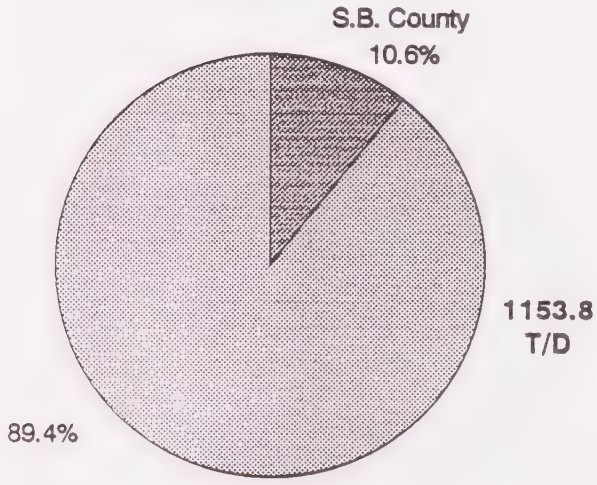
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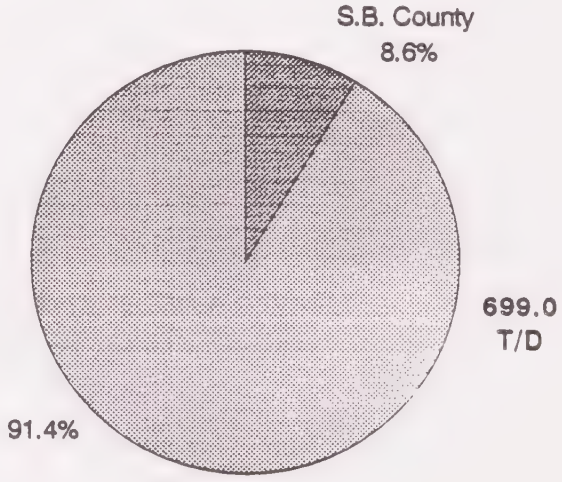
S.B. COUNTY



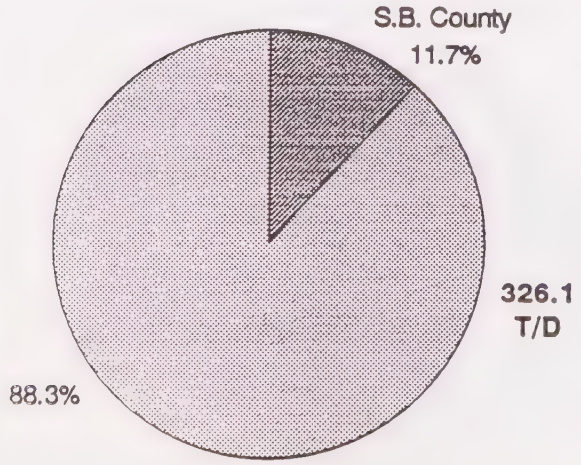
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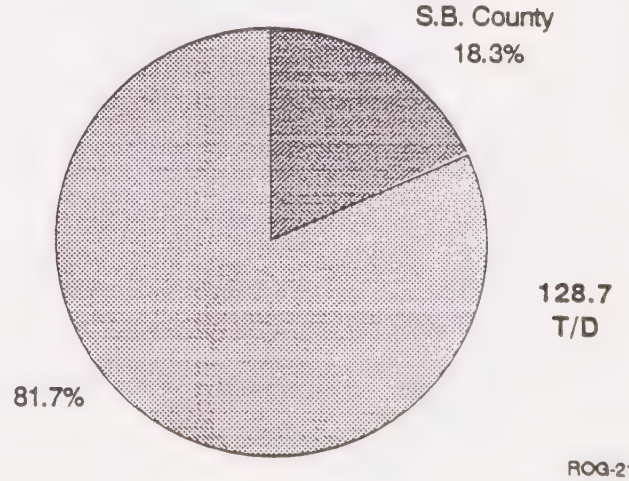
STATIONARY SOURCES



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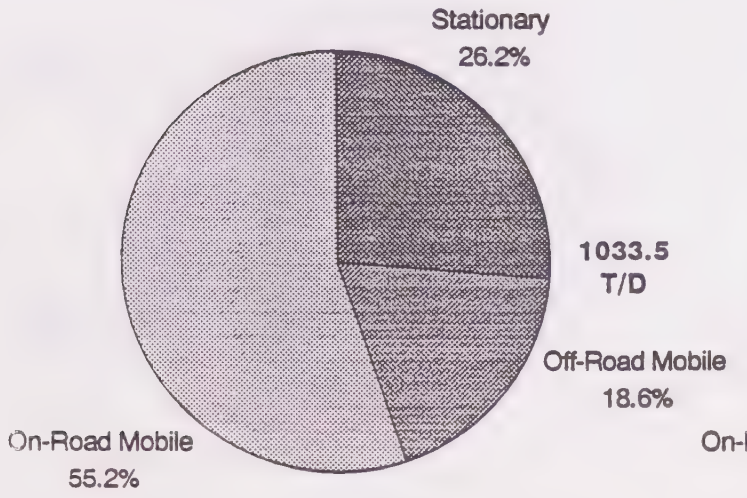
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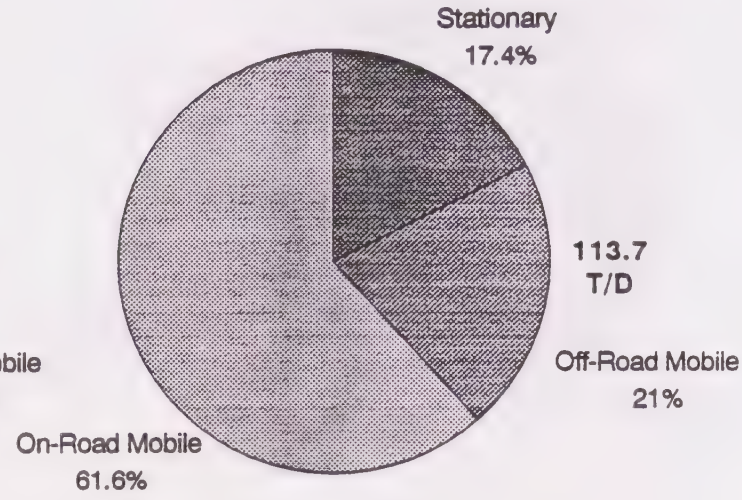
ROG-21.GEM

NOX EMISSIONS 2010

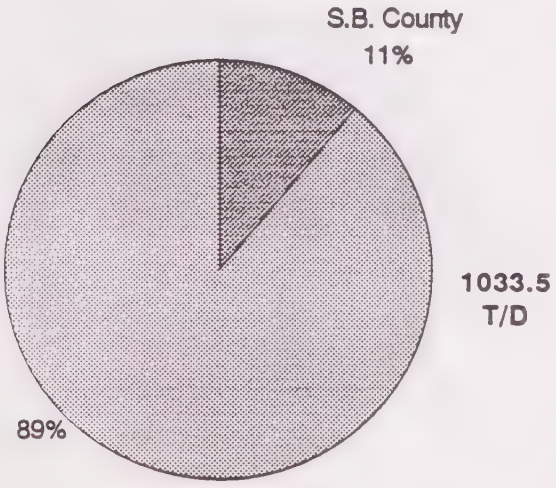
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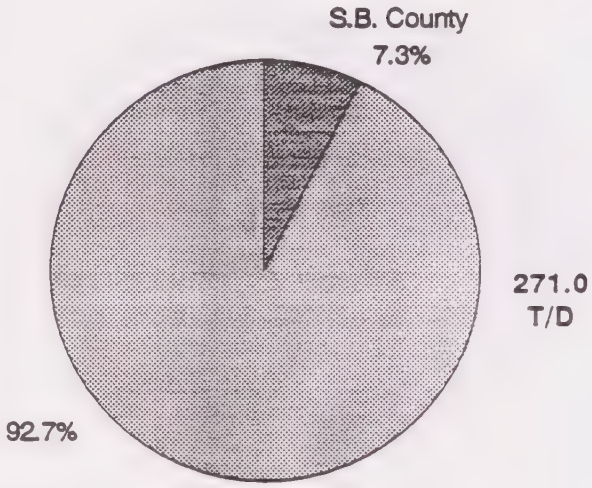
S.B. COUNTY



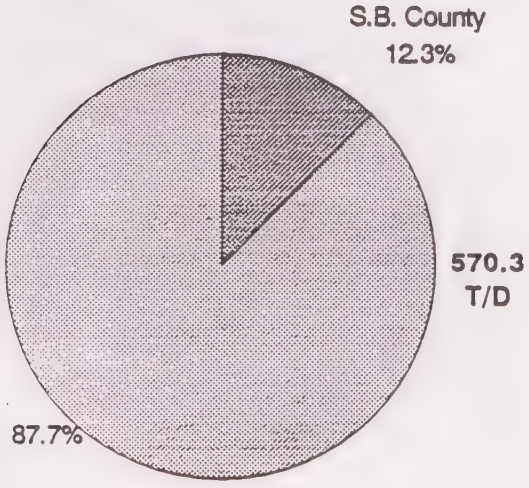
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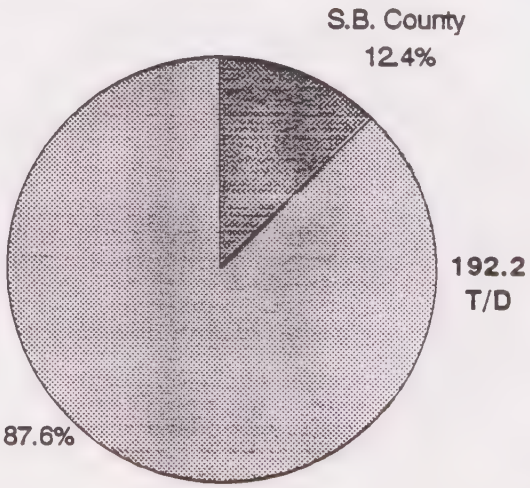
STATIONARY SOURCES



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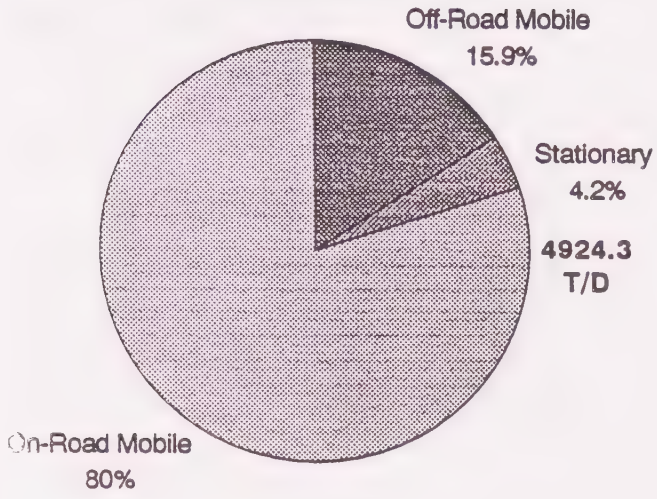
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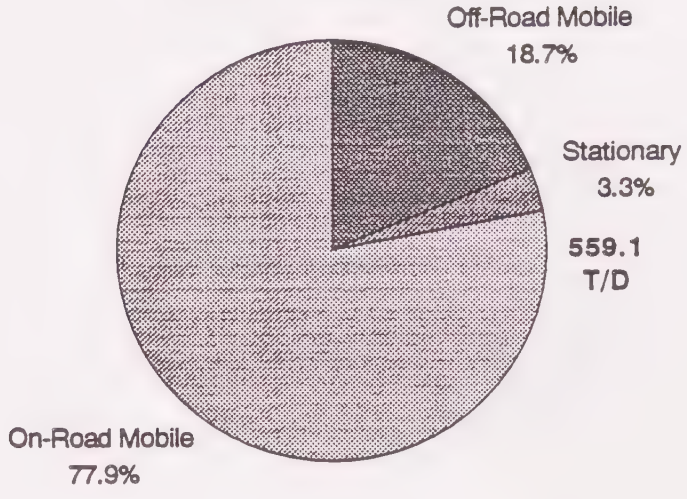
NOX-21.GEM

CO EMISSIONS 2010

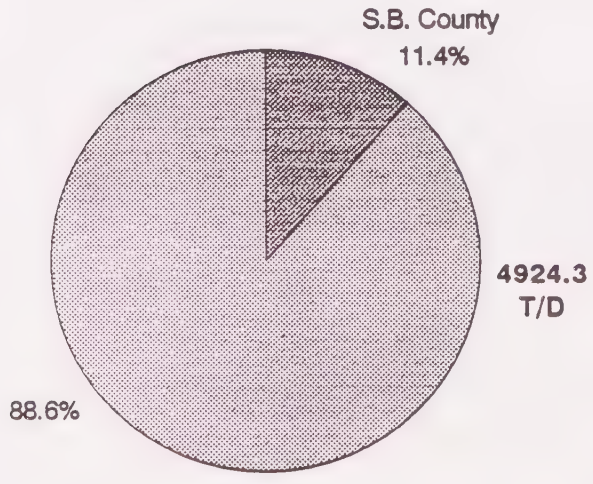
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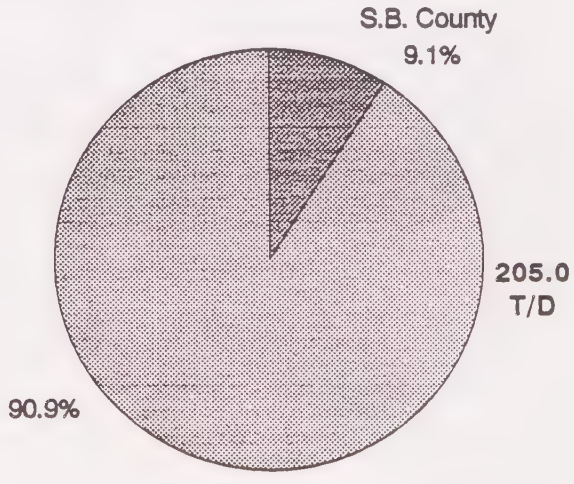
S.B. COUNTY



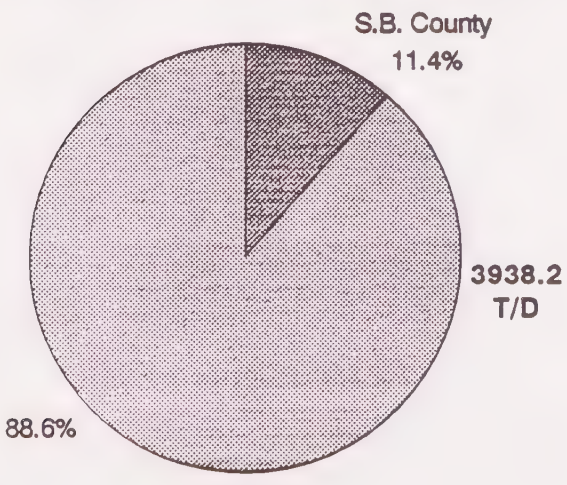
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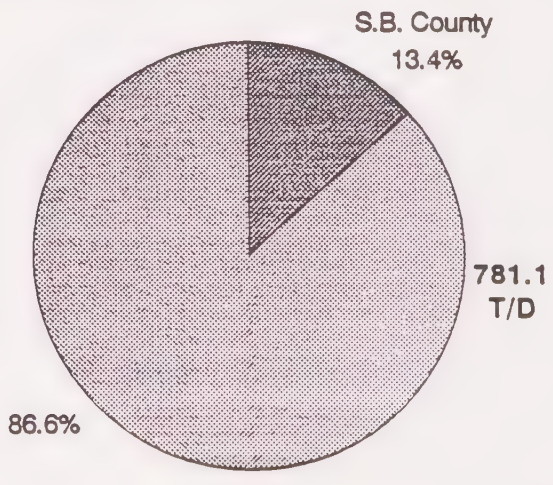
STATIONARY SOURCES



ON-ROAD MOBILE SOURCES



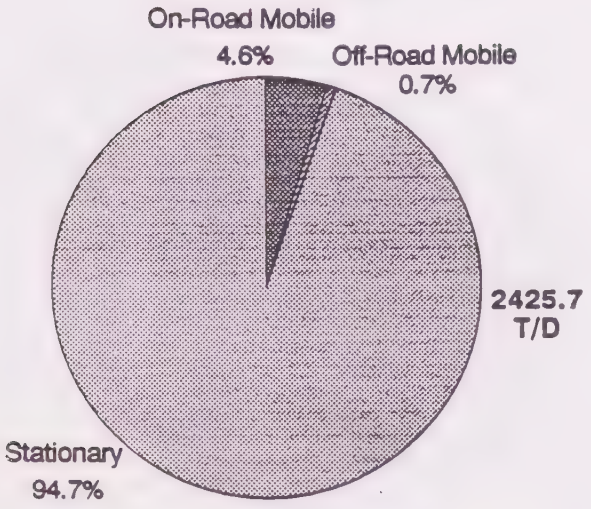
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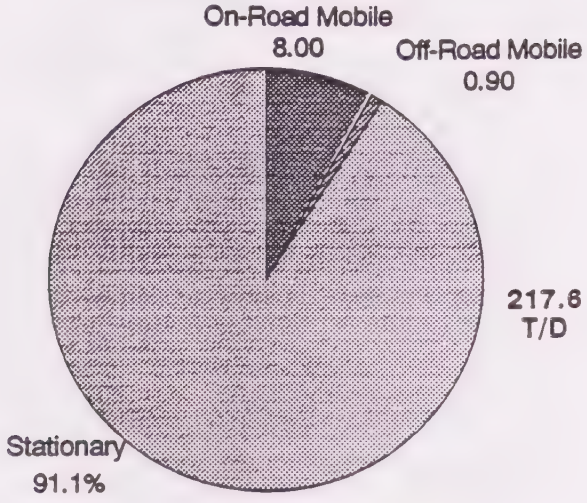
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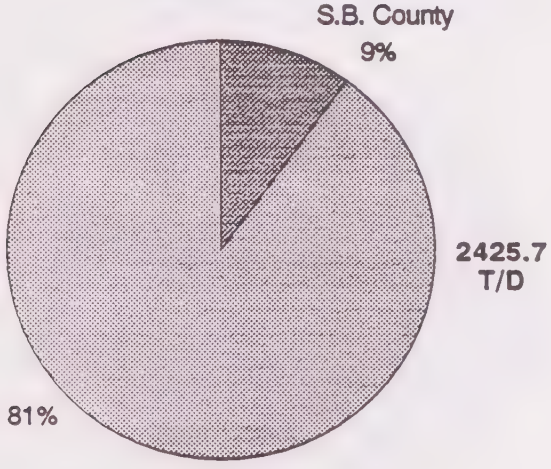
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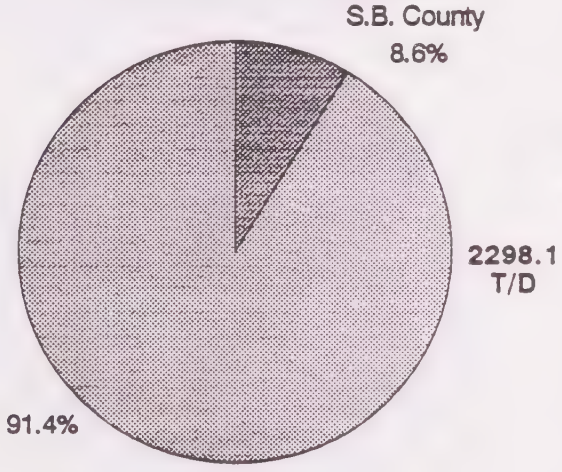
S.B. COUNTY



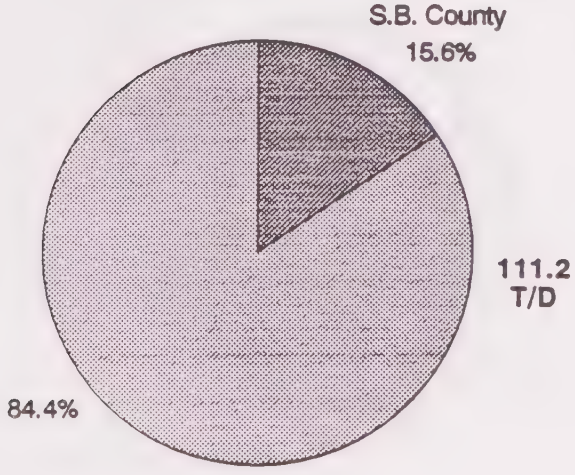
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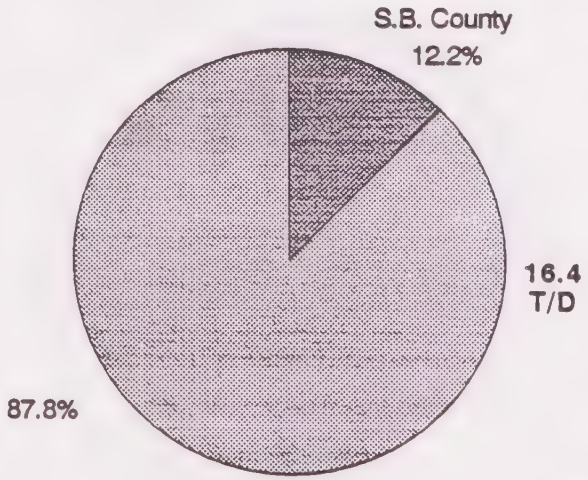
STATIONARY SOURCES



ON-ROAD MOBILE SOURCES



OFF-ROAD MOBILE SOURCES



PM2010.GEM

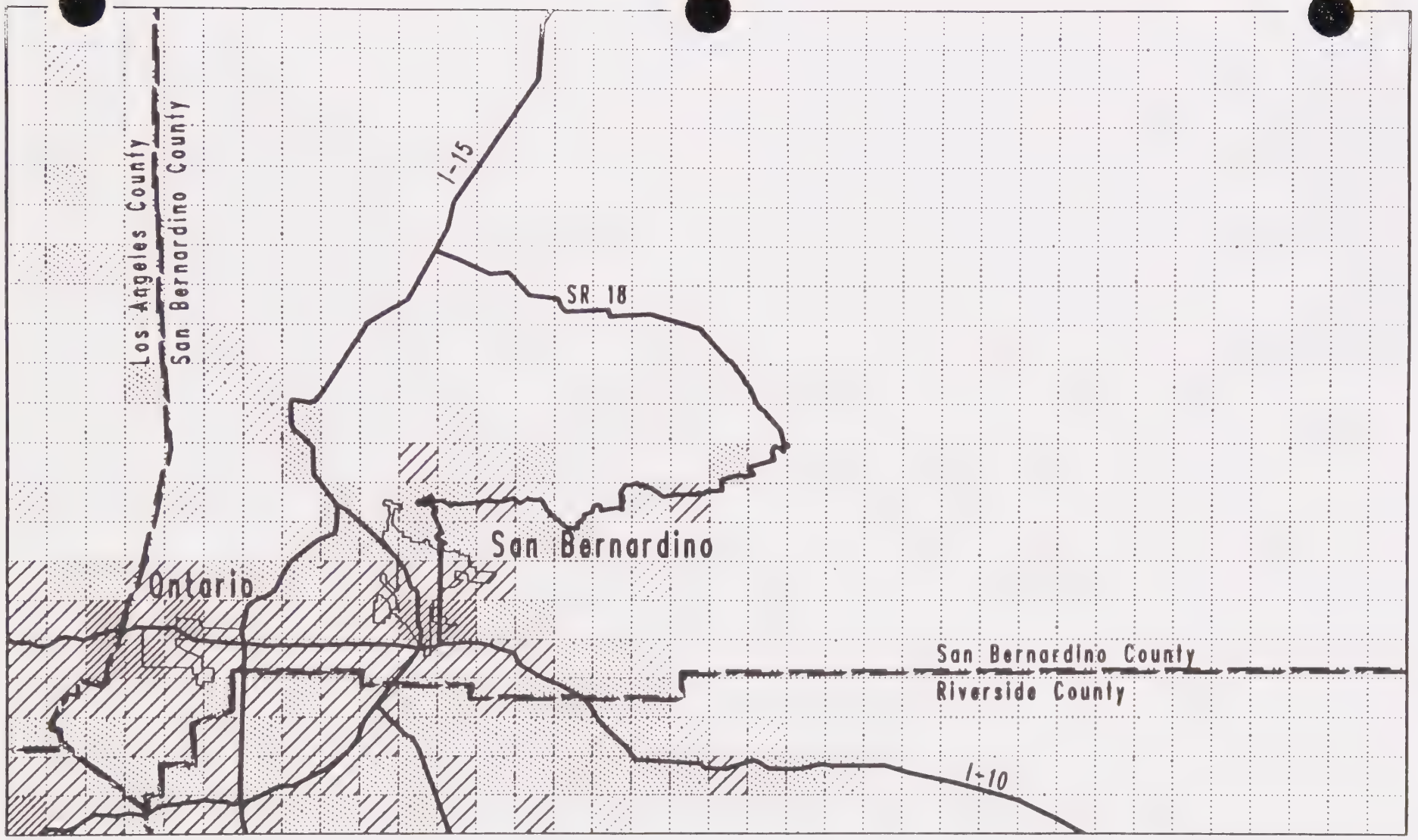
APPENDIX C

Spatial Source Emissions Distribution (ROG, NOx, CO)

1985 AQMP Development Inventory

2000 Baseline (No AQMP) Condition

2010 Baseline (No AQMP) Condition



San Bernardino County
Regional Air Quality Element

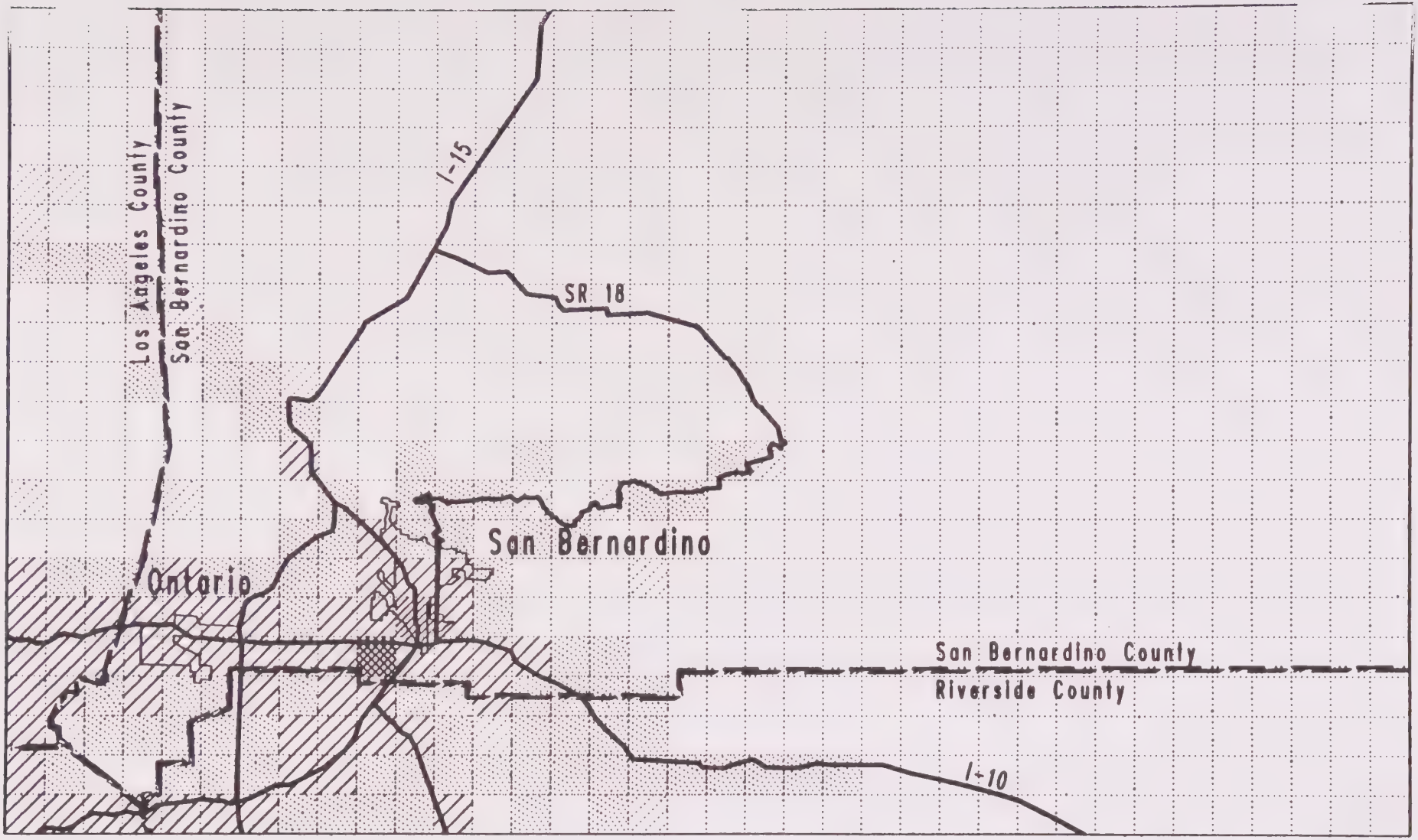
DAILY REACTIVE ORGANIC GAS EMISSIONS
1985 BASELINE

THE PLANNING CENTER

0 5 10 20 km

Legend

- LT or = 0.05 TONS
- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS



San Bernardino County
Regional Air Quality Element

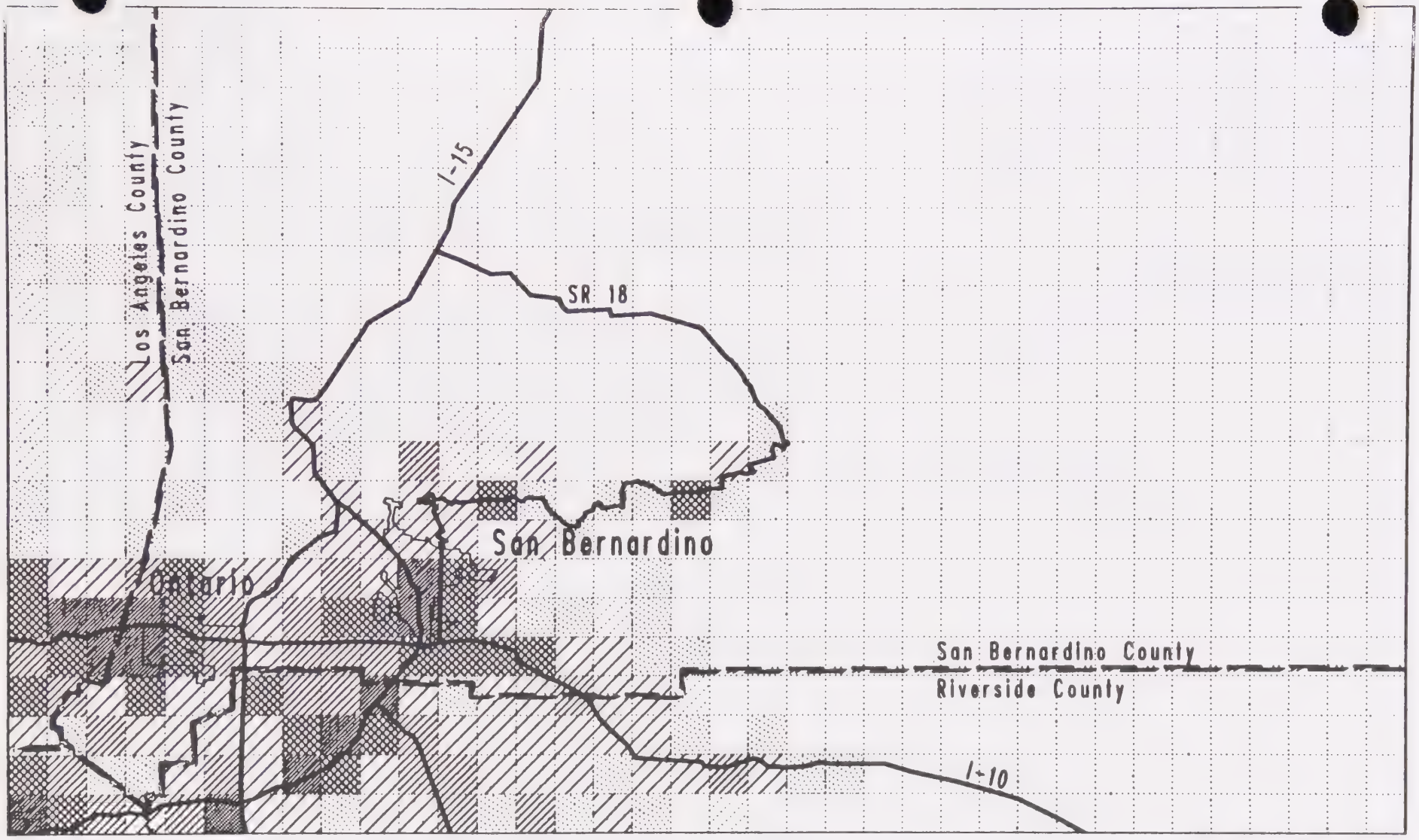
DAILY NITROGEN OXIDE EMISSIONS
1985 BASELINE

THE PLANNING CENTER

0 5 10 20 km

Legend

- LT or = 0.05 TONS
- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS



San Bernardino County
Regional Air Quality Element

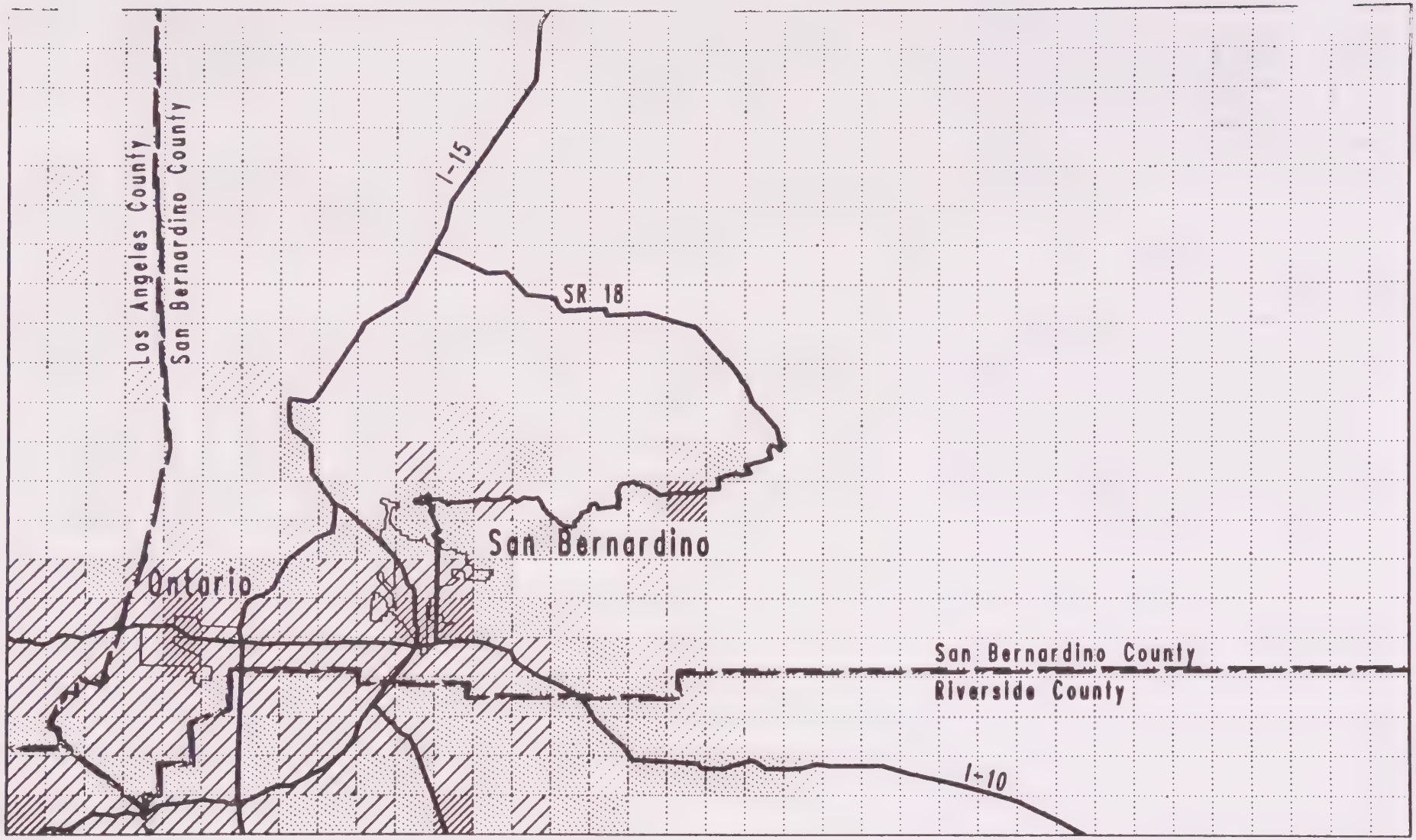
DAILY CARBON MONOXIDE EMISSIONS
1985 BASELINE

THE PLANNING CENTER

0 5 10 20 km

Legend

- LT or = 0.05 TONS
- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS



San Bernardino County
Regional Air Quality Element

DAILY REACTIVE ORGANIC GAS EMISSIONS
2000 BASELINE

THE PLANNING CENTER

0 5 10 20 km

Legend

- LT or = 0.05 TONS
- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS



San Bernardino County
Regional Air Quality Element

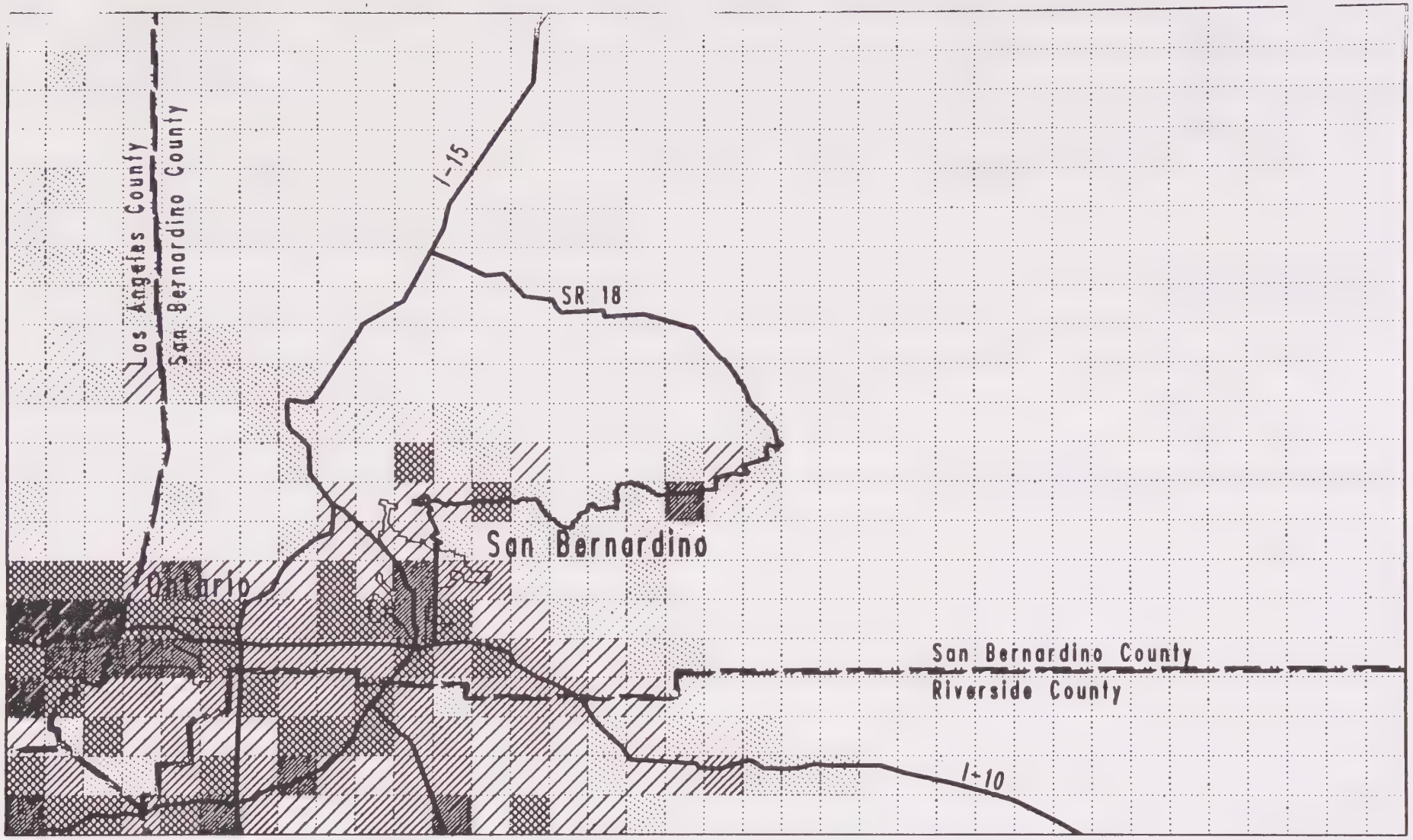
DAILY NITROGEN OXIDE EMISSIONS
2000 BASELINE

THE PLANNING CENTER

0 5 10 20 km

Legend

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- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS



San Bernardino County
Regional Air Quality Element

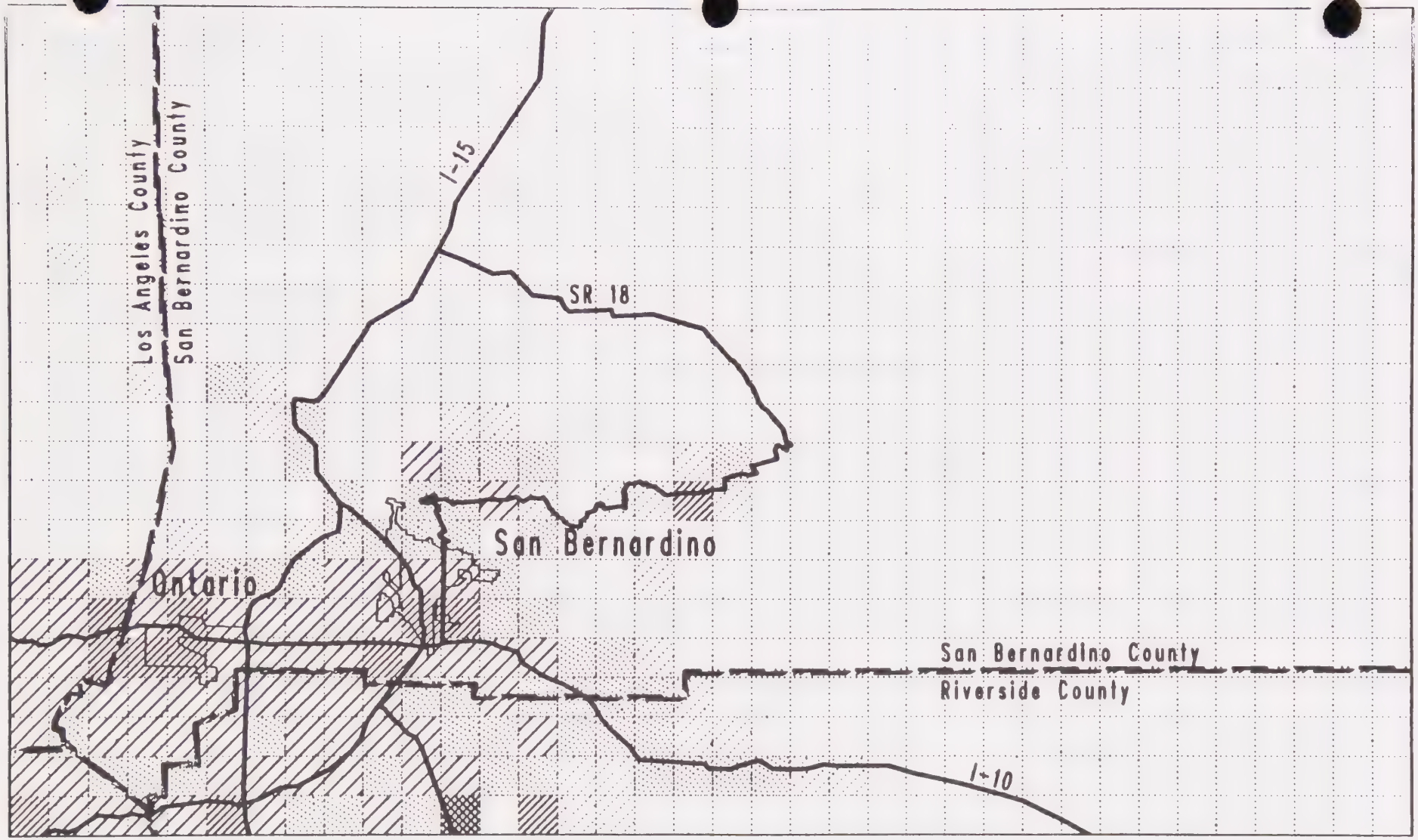
DAILY CARBON MONOXIDE EMISSIONS
2000 BASELINE

THE PLANNING CENTER

0 5 10 20 km

Legend

- LT or = 0.05 TONS
- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
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San Bernardino County
Regional Air Quality Element

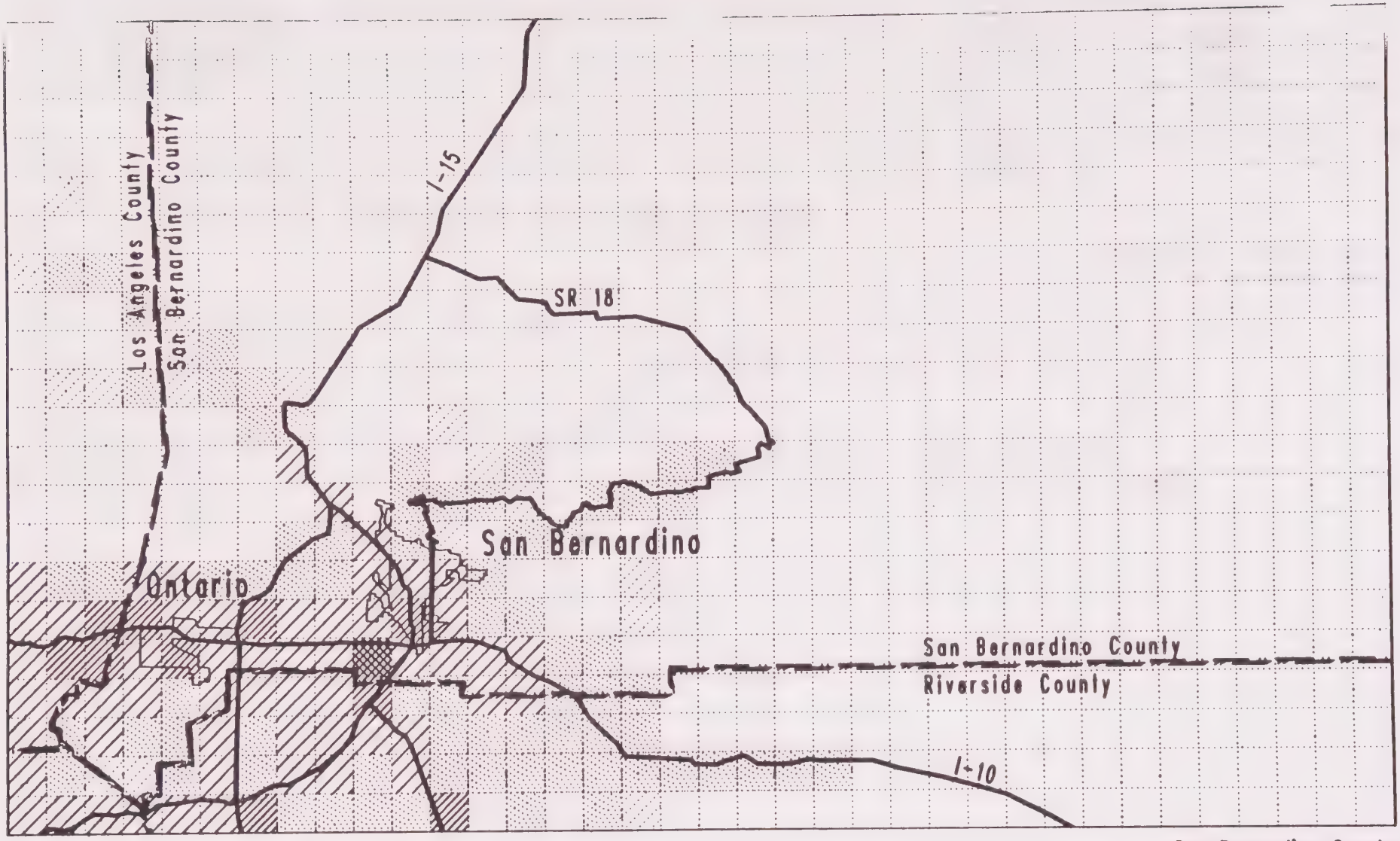
DAILY REACTIVE ORGANIC GAS EMISSIONS
2010 BASELINE

THE PLANNING CENTER

0 5 10 20 km

Legend

- LT or = 0.05 TONS
- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS



San Bernardino County
Regional Air Quality Element

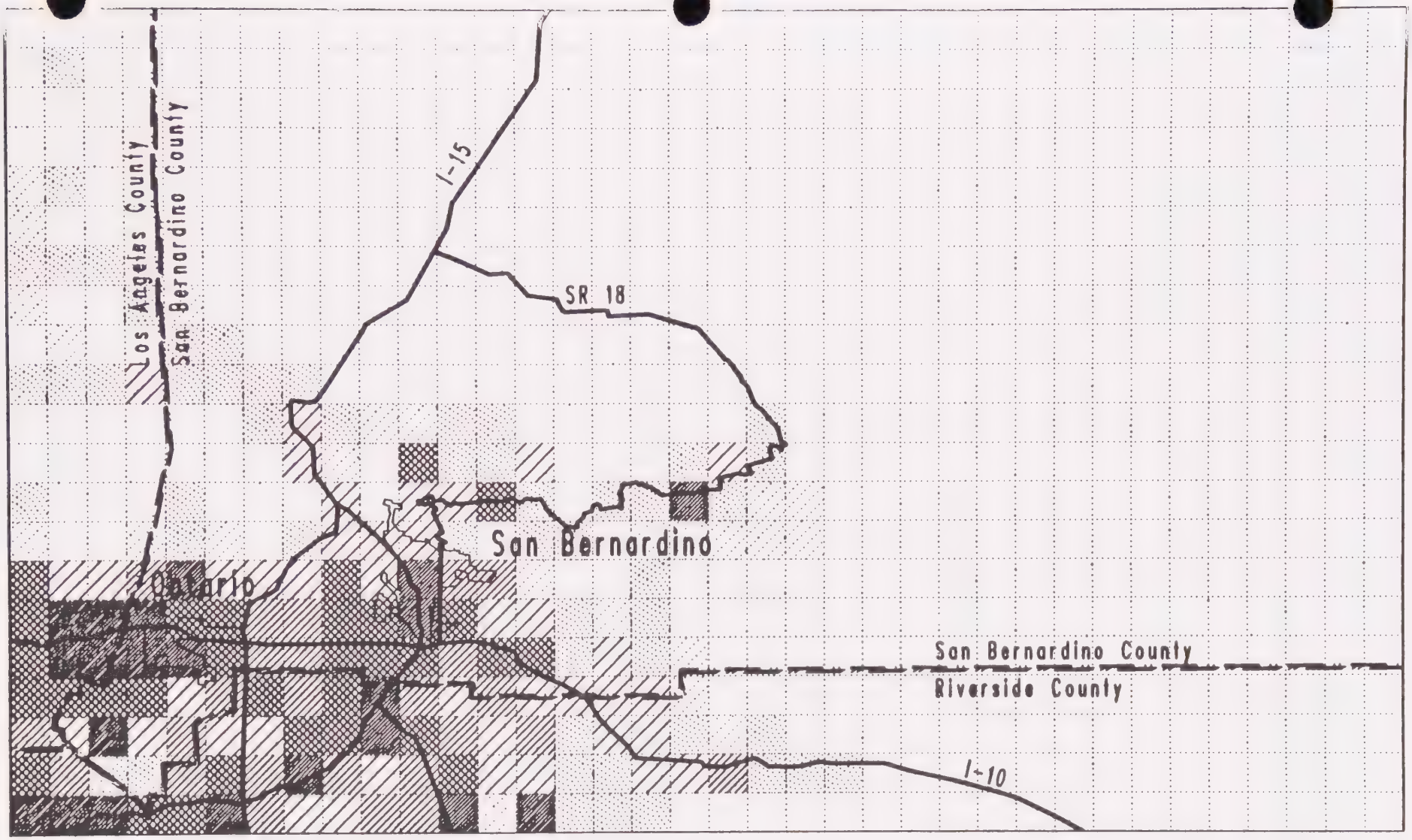
DAILY NITROGEN OXIDE EMISSIONS
2010 BASELINE

THE PLANNING CENTER

0 5 10 20 km

Legend

- LT or = 0.05 TONS
- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS



San Bernardino County
Regional Air Quality Element

DAILY CARBON MONOXIDE EMISSIONS
2010 BASELINE

THE PLANNING CENTER

0 5 10 20 km

Legend

- LT or = 0.05 TONS
- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS

APPENDIX D

San Bernardino County "Major"

Permitted Pollution Sources

(Tabular Summary and Spatial Plots)

MAJOR EMISSIONS STATIONARY SOURCES
SAN BERNARDINO COUNTY

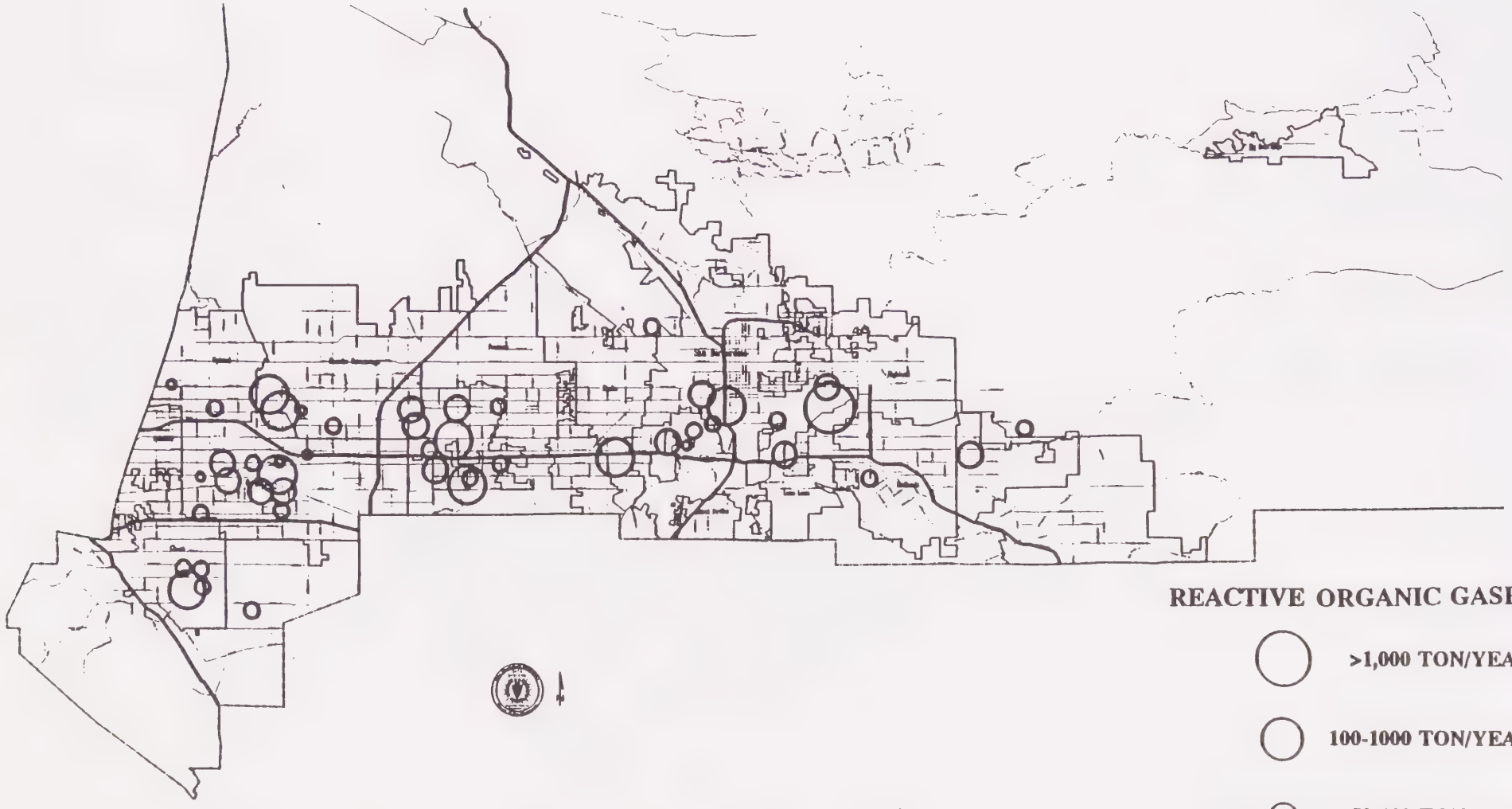
	Thomas Guide Map Ref.	Annual Emissions (TONS)			
		ROG	CO	NOX	PM
1. Cal Portland Cement, 695 S. Rancho, Colton	1. P27, A2	17.78	294.00	2,982.00	276.00
2. Norton AFB, San Bernardino	2. P17, D4	1,001.06	1,406.10	238.20	34.10
3. So. Cal. Edison, 8996 Etiwanda, Etiwanda	3. P13, B5	55.86	178.00	1,051.00	41.00
4. SPTC, West Colton Railyard, Colton	4. P26, B2	126.96	318.40	410.60	20.90
5. Fasson An Avery Int'l Co., 9292 9th Street, Cucamonga	5. P11, F4	608.71	00	9.00	00
6. Ontario Int'l Airport, Ontario	6. P22, F3	194.14	737.30	220.00	14.70
7. Cal Steel Ind. Inc., 14000 San Bernardino Avenue, Fontana	7. P13, D6	142.53	110.00	220.10	58.00
8. AT & SF, San Bernardino Railyard, San Bernardino	8. P16, C3	85.37	214.20	276.20	14.10
9. Inland Container, 5100 Jurupa Street, Ontario	9. P23, F4	7.01	73.00	251.00	10.00
10. Atchison, Topeka & Santa Fe Rail, 470 North L Street, San Bernardino	10. P16, C3	221.43	00	19.00	2.00
11. Ornyte Fiberglass Panels, 14000 Monte Vista Street, Chino	11. P33, D4	241.50	00	00	00
12. US Govt AF Dept, Norton AFB, 63rd Military Airlift Wing	12. P17, D4	53.24	7.00	64.00	5.00
13. Gold Shield Fiberglass Inc., 11751 Industry Ave., Fontana	13. P24, B5	136.50	00	00	00
14. Gen Marble, 9146 E. 9th Street, Cucamonga	14. P11, F4	118.23	00	00	00
15. Chino Airport, Chino	15. P34, C6	31.92	689.10	9.60	1.60
16. Sunkist Growers, Orange Products, 616 E. Sunkist St., Ontario	16. P22, C2	82.22	3.00	18.00	1.00
17. Cal St., Institute for Women, 16756 Chino-Corona Rd., Fontera	17. P38, D3	5.27	22.00	87.00	7.00

	Thomas Guide Map Ref.	Annual Emissions (TONS)			
		ROG	CO	NOX	PM
18. So. Cal. Edison, 25770, San Bernardino Ave., San Bernardino	P17, C6	4.33	8.90	71.00	4.00
19. Cal Home Brands Foods, 8939 Etiwanda Ave., Etiwanda	P13, B4	82.45	00	10.00	1.00
20. Richmond Div., Dixico Inc., Colton Avenue & Opal St., Redlands	P30, A2	77.60	00	12.00	00
21. Demert & Dougherty, 1705 S. Baker Ave., Ontario	P22, E4	87.75	00	00	00
22. Tamco, 12459 Arrow Hwy, Etiwanda	P13, A4	.67	194.00	50.00	15.00
23. Scotfoam Corp., 1400 E. Victoria Ave., San Bernadino	P28, B1	84.75	00	00	00
24. GOE Engineering, 1425 S. Vineyard, Ontario	P22, F4	67.00	2.00	8.00	00
25. Rialto Muni Airport	P6, A6	27.54	348.20	10.20	.80
26. Supracote, Inc., 11200 Arrow Hwy., Cucamonga	P13, D4	62.82	00	10.00	1.00
27. Rialto City, Wastewater Plant, 510 E. Santa Ana Ave., Rialto	P26, D3	.47	1.00	64.00	5.00
28. Spectrotape Corp., 345 W. Valley Blvd., Colton	P27, A1	64.47	00	4.00	00
29. Cable Airport, Plano, Upland	P10, E2	11.32	530.60	.80	1.20
30. Union Carbide, Linde Div., 5705 Aiport Dr., Ontario	P24, A2	2.26	18.00	54.00	4.00
31. San Bernardino Co., Medical Cntr., 780 E. Gilbert, San Bernardino	P8, A6	1.20	.60	50.59	2.77
32. Van Camp Sea Food Co., 10837 Etiwanda Ave., Fontana	P24, B3	55.63	00	5.00	00
33. Gen Electric Co., Aviation Service, Ontario Int'l Aiport	P22, F3	10.21	7.00	31.00	2.00
34. GAF Corp., 11800 Industry Ave., Fontana	P24, B5	35.47	3.00	7.00	13.00

	Thomas Guide Map Ref.	Annual Emissions (TONS)			
		ROG	CO	NOX	PM
35. Alger MFG Co., 724 South Bon View, Ontario	P22, C3	51.00	00	00	00
36. Fruit Growers Supply Co., 225 S. Wineville, Ontario	P23, F2	.44	1.00	45.00	4.00
37. San Bernardino Co, EPWA, County Jail, 630 E. Rialto Ave., San Bernardino	P16, F3	1.11	.57	12.35	3.74
38. Highland Supply Corp., 1500 Crafton Ave., Redlands	P19, B6	47.09	00	00	00
39. Heckett Slag, Harsco Corp. Div., 8888 Calabash, Fontana	P13, D4	5.62	25.00	33.00	3.00
40. Lockheed Aircraft Serv., Co., Lockheed Hanger 19 South, Ontario Int'l Airport	P22, F3	43.49	00	00	1.41
41. HIggins Brick Co., 15920 Pomona-Rincon Rd., Chino	P37, E2	1.80	7.00	40.00	2.00
42. Ameron-Price Co., 13189 Slover Avenue, Fontana	P24, B2	27.19	23.00	6.00	9.00
43. Tecon Pacific, 13592 Slover Avenue, Fontana	P24, C2	00	00	00	43.68
44. Western Insulfoam Corp., 5635 Shaefer Ave., Chino	P33, E3	40.00	1.00	2.00	00
45. Sundance Spas, Clark MFG Inc., 13951 S. Monte Visa Ave., Chino	P33, D3	40.25	00	00	00
46. La-Z-Boy West, 310 Tennessee St., Redlands	P29, A3	38.59	00	00	00
47. Karel Co., 110 N. 3rd Ave., Upland	P11, B4	37.99	00	00	00
48. So. Cal. Edison, 12700 Taylor St., Colton	P42, A1	.91	1.00	33.00	00
49. A-1 Gnt. Co., Newman Bros Cal. C., 8203 Alabama St., Redlands	P17, F4	00	2.10	27.80	6.25
50. Industrial Asphalt, 840 E. 20th St., Upland	P2, C5	.58	.46	23.92	11.44
51. Williams Furnace Co., 225 Acacia St., Colton	P16, B6	33.94	00	2.00	00

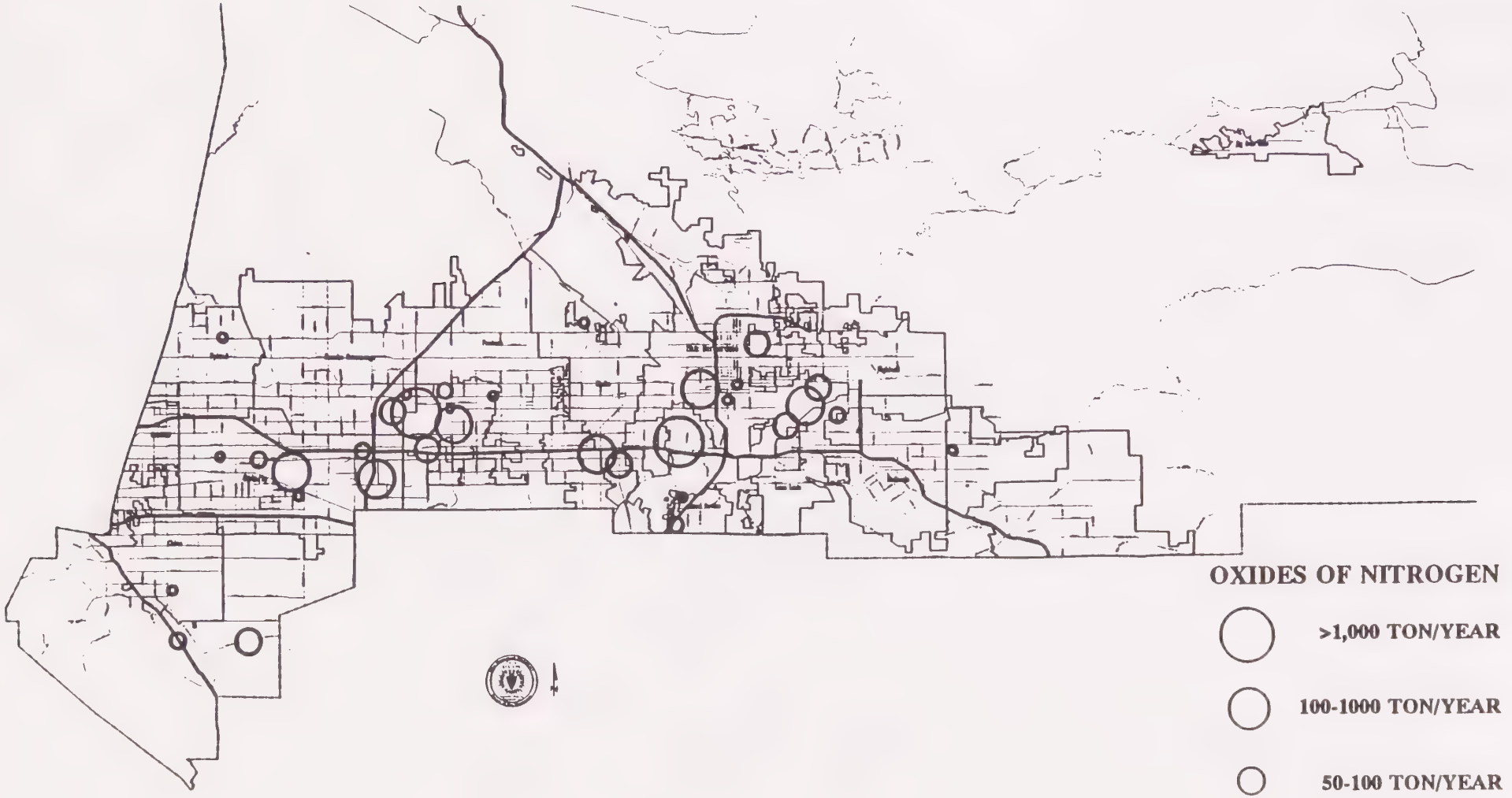
	Thomas Guide Map Ref.	Annual Emissions (TONS)			
		ROG	CO	NOX	PM
52. Cal Acrylic Ind. Inc., 2334-2336 S. Vineyard Ave., Ontario	P22, F5	32.66	00	00	2.80
53. Cal Finished Metal Inc., 9133 Center Ave., Cucamonga	P12, C5	25.83	00	8.00	1.00
54. Welch's Overall Cleaning Co., 940 W. Oak St., San Bernardino	P16, D4	30.94	00	2.00	00
55. Fontana Paving 8747 S. Lime Ave., Fontana	P14, A4	1.34	.30	15.00	16.00
56. Cal. St., Institute for Men, 14901 Central Avenue, Chino	P33, E5	8.44	00	21.00	2.00
57. Knudsen System Inc., 14055 Laurelwood Place, Chino	P33, C4	29.00	00	00	00
58. Chino Basin Municipal Water District, 2450 Philadephia St., Ontario	P23, A5	4.21	13.24	16.54	1.77
59. Road Systems Inc., 8432 Almeria, Fontana	P14, A3	27.33	1.00	1.00	00
60. Hume Roofing Tiles, 10650 Poplar Ave., Fontana	P25, A2	25.30	1.00	3.00	00
61. Elixir Ind. Inc., 1380 S. Bon View Ave., Ontario	P22, C3	22.23	1.00	1.00	4.00
62. Haley Bros Inc., 1592 E. San Bernardino Ave., San Bernardino	P17, B5	24.56	3.00	3.00	00
63. Sure-Way Paint & Body Inc., 11900 La Crosse Rd., Grand Terrace	P27, B5	8.12	.33	17.50	1.50
64. O.H. Kruse Grain & Milling, 310 S. San Antonio, Ontario	P22, A2	26.10	00	1.00	00
65. GEN Marble Corp., 2701 E. Guasti Road, Guasti	P23, A2	10.46	00	.08	16.25
66. Redlands Comm. Hospital, 350 Terracina Blvd at Laurel Ave., Redlands	P29, A5	.65	.26	7.78	2.10
67. Western Metal Decorating, 8875 Industry Lane, Cucamonga	P12, A4	19.88	00	6.00	00
TOTAL ANNUAL		4,473.26	5,246.66	6,571.26	667.11
DAILY AVERAGE		12.26	14.37	18.00	1.83

THE PLANNING CENTER



REGIONAL AIR QUALITY PLAN
SAN BERNARDINO COUNTY/CITIES


CARBON MONOXIDE
>1,000 TON/YEAR
100-1000 TON/YEAR
50-100 TON/YEAR
25-50 TON/YEAR
10-25 TON/YEAR


OXIDES OF NITROGEN
>1,000 TON/YEAR
100-1000 TON/YEAR
50-100 TON/YEAR
25-50 TON/YEAR
10-25 TON/YEAR



PARTICULATE MATTER

>1,000 TON/YEAR

100-1000 TON/YEAR

50-100 TON/YEAR

25-50 TON/YEAR

10-25 TON/YEAR


OXIDES OF SULPHUR
>1,000 TON/YEAR
100-1000 TON/YEAR
50-100 TON/YEAR
25-50 TON/YEAR
10-25 TON/YEAR

APPENDIX E

Gridded Air Pollution Emissions Distribution (ROG, NOx, CO)

Year 2010 Tier I AQMP Implementation

Year 2010 Tier II AQMP Implementation

Year 2010 Tier III AQMP Implementation



San Bernardino County
Regional Air Quality Element

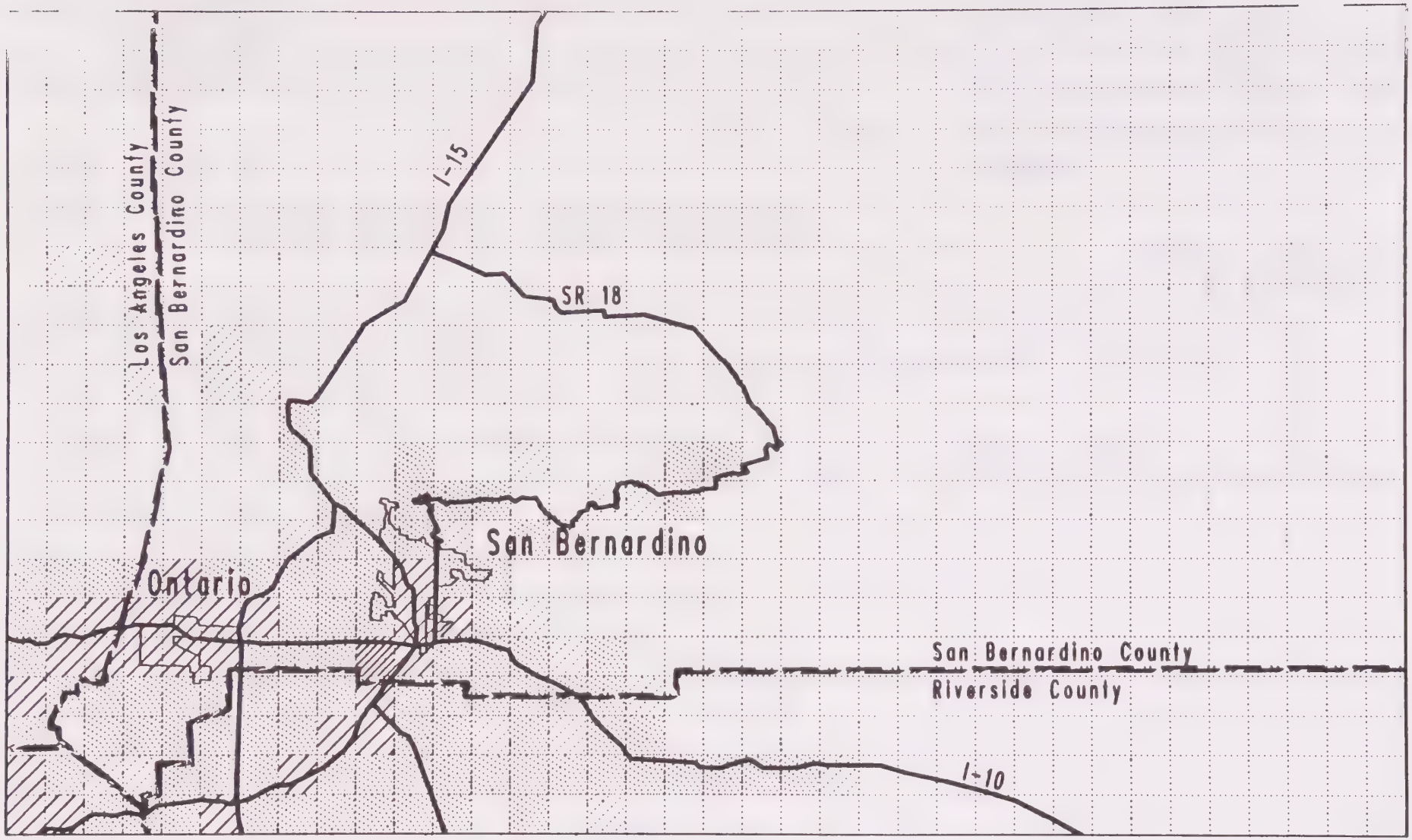
DAILY REACTIVE ORGANIC GAS EMISSIONS
2010 TIER I

THE PLANNING CENTER

0 5 10 20 km

Legend

- LT or = 0.05 TONS
- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS



San Bernardino County
Regional Air Quality Element

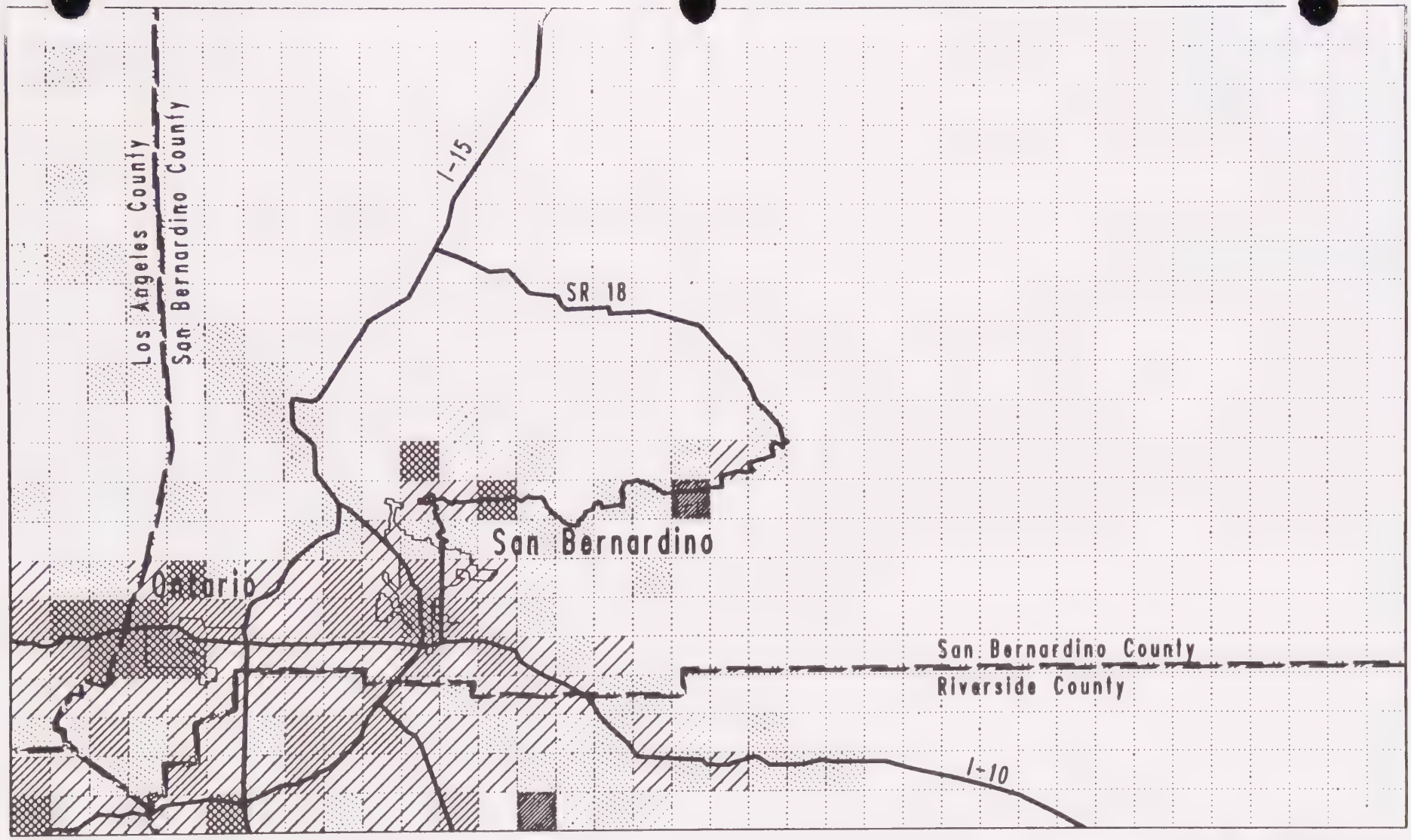
DAILY NITROGEN OXIDE EMISSIONS
2010 TIER I

THE PLANNING CENTER

0 5 10 20 km

Legend

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- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS



San Bernardino County
Regional Air Quality Element

DAILY CARBON MONOXIDE EMISSIONS
2010 TIER I

THE PLANNING CENTER

0 5 10 20 km

Legend

- LT or = 0.05 TONS
- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS



San Bernardino County
Regional Air Quality Element

DAILY REACTIVE ORGANIC GAS EMISSIONS
2010 TIER II

THE PLANNING CENTER

0 5 10 20 km

Legend

- LT or = 0.05 TONS
- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS



San Bernardino County
Regional Air Quality Element

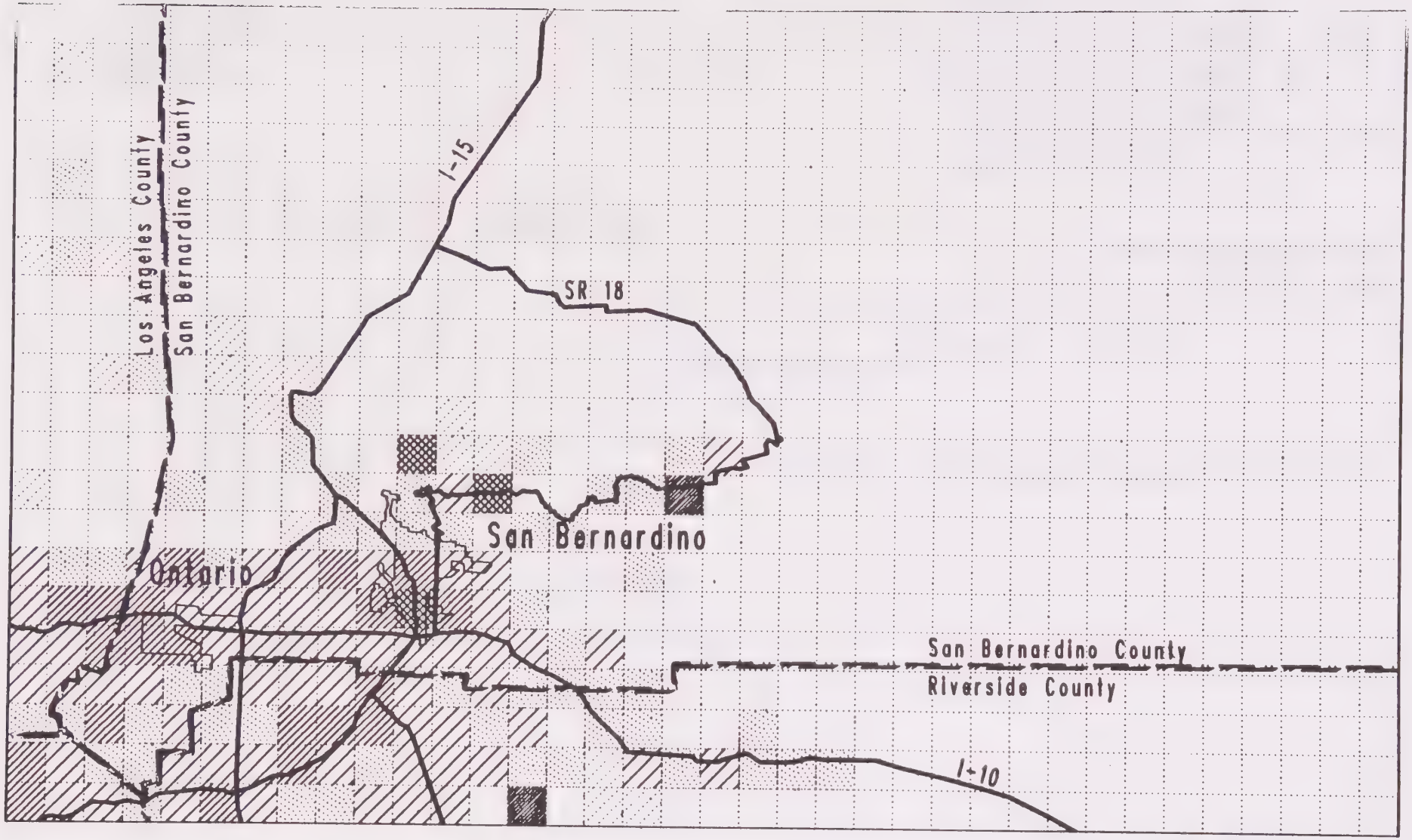
DAILY NITROGEN OXIDE EMISSIONS
2010 TIER II

THE PLANNING CENTER

0 5 10 20 km

Legend

- LT or = 0.05 TONS
- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS



San Bernardino County
Regional Air Quality Element

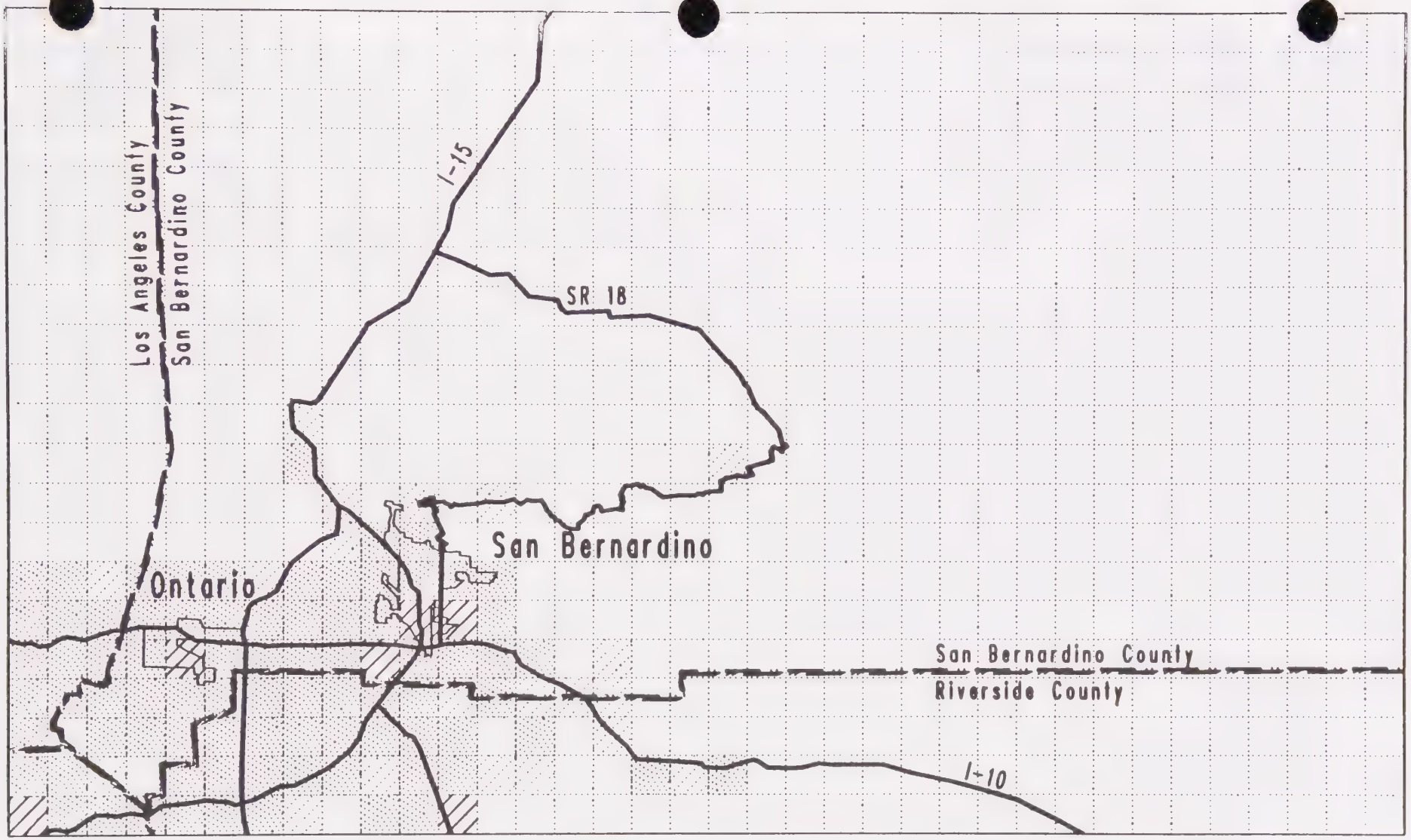
DAILY CARBON MONOXIDE EMISSIONS
2010 TIER II

THE PLANNING CENTER

0 5 10 20 km

Legend

- LT or = 0.05 TONS
- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS



San Bernardino County
Regional Air Quality Element

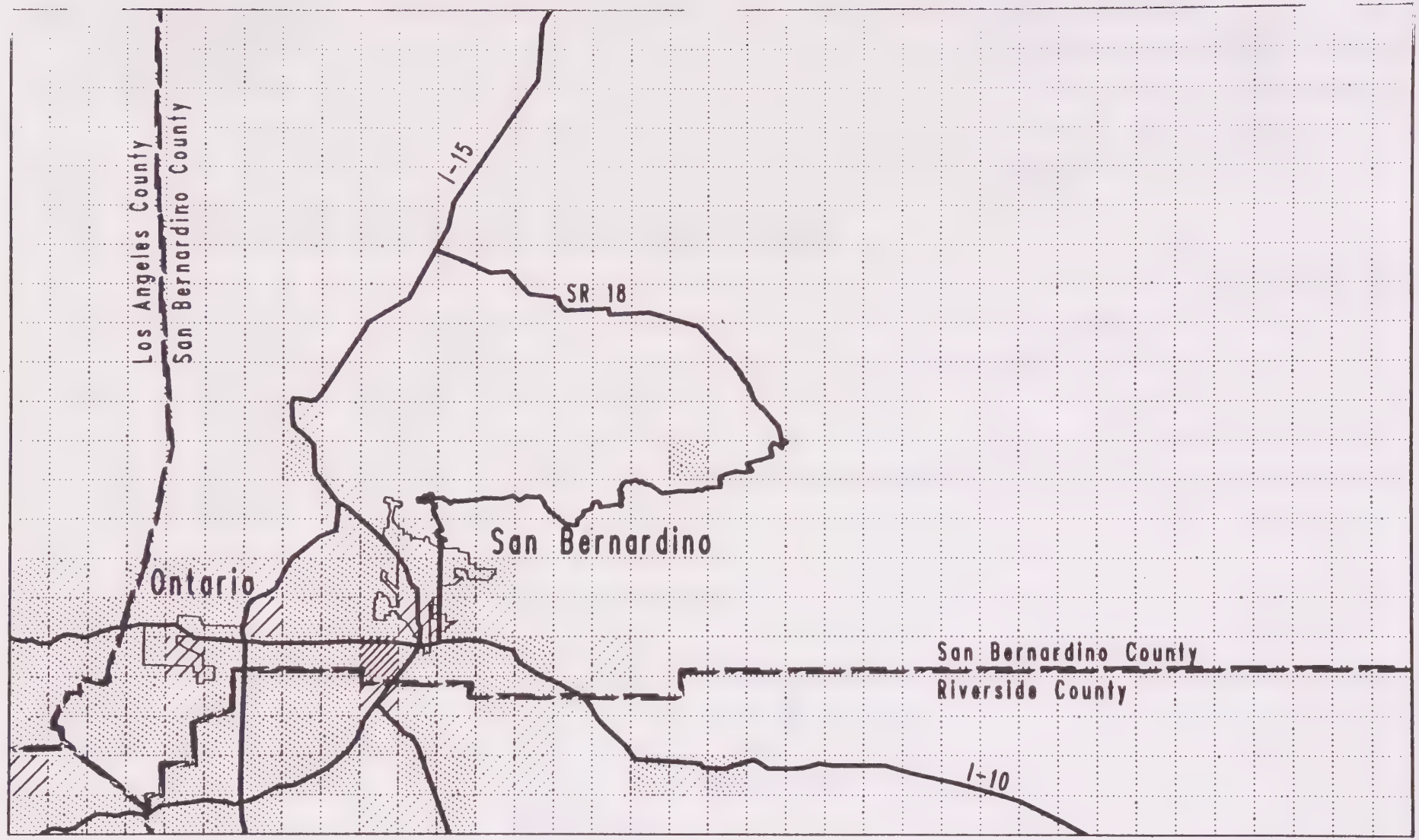
DAILY REACTIVE ORGANIC GAS EMISSIONS
2010 TIER III

THE PLANNING CENTER

0 5 10 20 km

Legend

- LT or = 0.05 TONS
- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS



San Bernardino County
Regional Air Quality Element

DAILY NITROGEN OXIDE EMISSIONS
2010 TIER III

THE PLANNING CENTER

0 5 10 20 km

Legend

- LT or = 0.05 TONS
- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS



San Bernardino County
Regional Air Quality Element

DAILY CARBON MONOXIDE EMISSIONS
2010 TIER III

THE PLANNING CENTER

0 5 10 20 km

Legend

- LT or = 0.05 TONS
- 0.06 to 0.10 TONS
- 0.11 to 1.00 TONS
- 1.01 to 5.00 TONS
- 5.01 to 10.00 TONS
- 10.01 to 20.00 TONS
- GT 20.00 TONS

WATER

WATER DISTRIBUTION SYSTEMS

I. INTRODUCTION

A. Definition

Southern California and water have always been, and always will be, inextricably linked. The supply of water is vital to urban areas, agriculture, industry, and recreation for the general health, safety, and welfare of the populace. In our arid climate, the importance of water resources and distribution facilities are clearly evident and cannot be overstated. The County of San Bernardino faces water supply and distribution issues not in isolation, but in common with all other counties in the Southern California region and the state as a whole. Within the county, there is a wide range of issues, including:

- Too little water in the Desert and some Mountain planning areas due to the overdrafting of groundwater basins, and insufficient import capability, leaving these areas dependent on dwindling supplies.
- Availability of imported water in the Mojave Water Agency area, but no facilities to receive and distribute imported water entitlements.
- A proposed 70-mile pipeline from the California Aqueduct at the Hesperia turnout to Yucca Valley in order to supply the area with much-needed imported water, and the provision of additional turnouts along the Aqueduct to serve the Victor Valley area.
- An inevitable increased reliance on imported water to meet growing needs, but no funded extensions to SWP facilities to expand supplies to meet maximum entitlements.
- Reductions in entitlements to Colorado River imported water for the MWD/CBMWD area.
- The need for rehabilitation of aged water distribution systems which lose a significant amount of water due to leaks.

- The problem/challenge of coordinating development and growth with a multitude of independently governed water service systems in a large and rapidly developing county.

- "Dry" subdivisions and minimum parcel sizes for provision of water supply - should the 2 1/2 acre threshold for requiring water service be increased to 5 acres? 10 acres?

- "Can" and "Will Serve" letter requirements for water service in development proposals; does the present system work adequately and should changes be considered?

- Widely varying patterns of water use throughout the county in Valley/Mountain/Desert planning areas, making widely varying service "standards".

- Who controls water systems, capital improvements, phasing and timing, location, etc. and who pays? How does the county keep track of the multiplicity of water service systems and coordinate with land use planning?

- Inability of water systems to meet peak load water supply requirements for domestic use, fireflow and emergency storage, and the possibility of expanding the requirements to areas other than fire and geologic hazard areas.

- Forecasts of water shortages by regional and state water agencies in the mid and long term if additional water importation facilities are not built.

This section of the background appendix will identify, inventory, quantify and describe the relationships of agencies at state, regional, and local level that play a role in the distribution and supply of water in San Bernardino County. The water distribution systems issue is part of the overall Natural Resources Component, of the General Plan, but is also closely related to the Man-Made Resources Component which is intended to establish a framework for the coordination of the County's land use planning process with the planning of public services and facilities. It should be noted that a section of the background appendix on the issue of groundwater supply and quality has also been prepared as part of the Natural Resources Component. A small

degree of overlap in the two issues is inevitable; the intent is to focus as much as possible on the provision of water service and conveyance systems in this section. Groundwater supply and water quality are covered in a separate section of the background appendix.

II. CURRENT STATUS

A. Sources of Data/Analysis

There is generally no shortage of information sources on the issue of water distribution. So much information is available that it can be an overwhelming task to sift and sort through the many documents and maps. At state level the California Department of Water Resources and the Water Education Foundation have both supplied several bulletins and reports. At a regional and county level information has been obtained from the California Department of Health Services through their San Bernardino office, the Metropolitan Water District of Southern California (MWD), the Southern California Association of Governments (SCAG), Chino Basin Municipal Water District (CBMWD), San Bernardino Valley Municipal Water District (SBVMWD), Mojave Water Agency (MWA), Crestline-Lake Arrowhead Water Agency (CLAWA), and San Bernardino County Department of Environmental Health Services (EHS).

As part of the effort to analyze data gathered from various sources, the San Bernardino County Land Management Department has contracted with a consultant, URS Corporation, to design a computerized system for the assessment of the availability of various public services, one of which is water service/distribution. The first phase of the system development has been completed. However, the system will not be fully operational prior to the completion of the two-year General Plan Update, but may continue as part of the five-year program.

The County's Victor Valley Infrastructure Enhancement Program (VVIEP), which commenced in early 1986 and was completed in November 1988, identified overall public service demands and needs in that area of the North Desert planning area, including water service. Information from this project has been utilized to the maximum extent possible for the Victor Valley area.

B. Scope of Existing Conditions/Trends

The fundamental dilemma behind California's water is one of distribution, coupled with competition for use of available supplies. Approximately three quarters of the state's available water originates north of Sacramento, while three quarters of the demand occurs south of the capital, as indicated in Fig. 1.

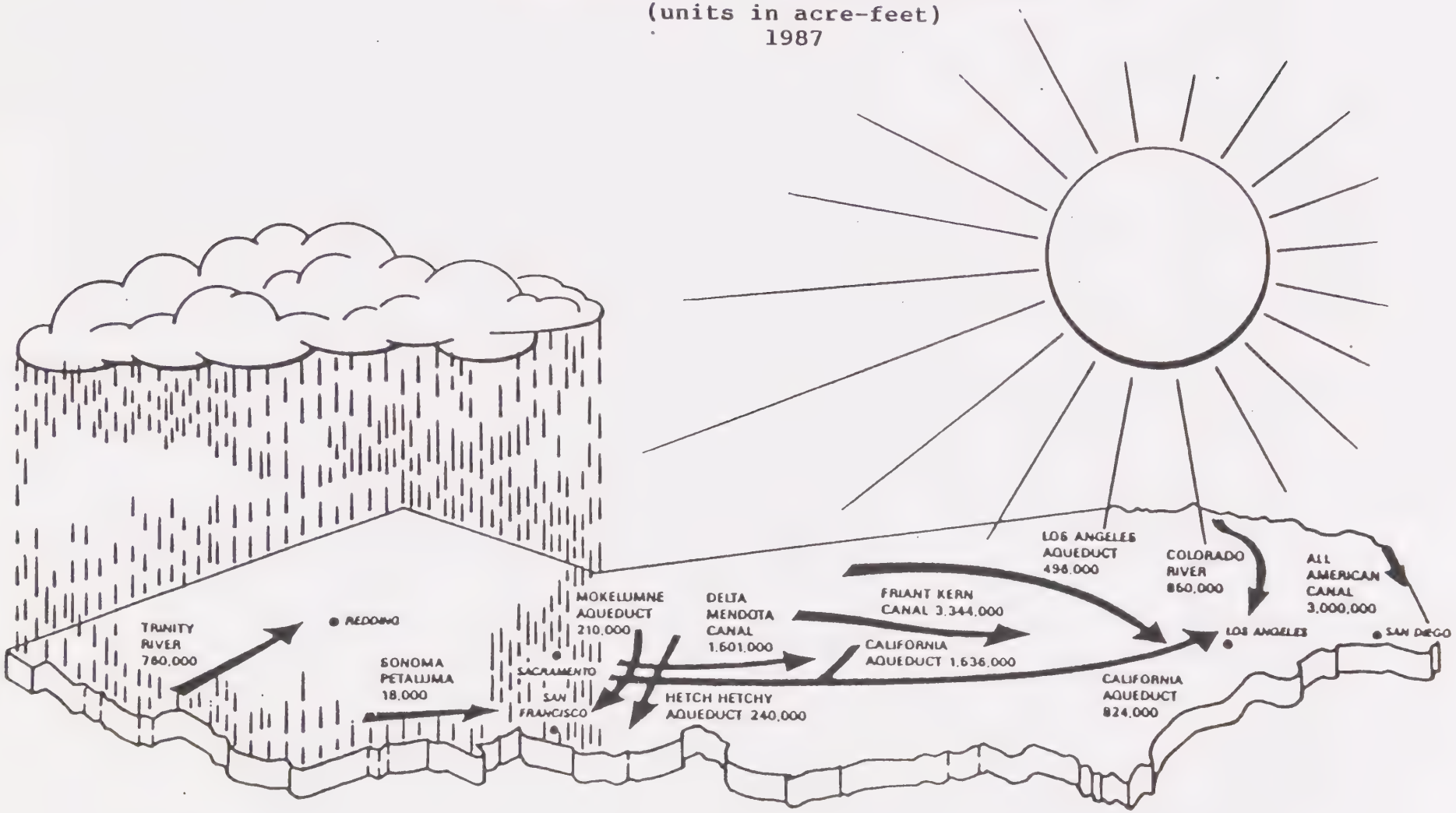
At the heart of California water is the Sacramento-San Joaquin Delta, a 700,000 acre region where the Sacramento and San Joaquin rivers meet. Through the Delta's maze of waterways passes water to satisfy the demands of the Delta itself, the San Francisco Bay area, the agricultural San Joaquin Valley, and millions of Southern Californians.

In addition to California's surface water supplies, underground water sources supply about 40 percent of the state's needs. Ground water is stored in the pore spaces between rocks and other alluvial materials, such as sand and gravel, beneath the earth's surface. Aquifers (water-bearing formations), or groundwater basins, can extend hundreds of miles and store huge amounts of water. Estimated water in groundwater basins, and water usage generally, is often quantified in acre-feet (AF) of water. An acre-foot of water consists of 325,851 U.S. gallons, and will cover an acre to a depth of one foot. Sizeable groundwater basins contain many million acre-feet of water. One acre-foot of water is generally recognized as the amount used annually by a household of four or five people.

California water resources have been developed by a diverse mix of private, local, state, and federal agencies. The water provides a multitude of benefits for homes, farms, industry, recreation, and enhancement of fish and wildlife resources, and improvement of navigable waterways. It has also significantly altered the natural environment, as scenic valleys with rushing streams have been flooded to form reservoirs, and water diverted for urban or agricultural uses sometimes means less for instream fishing and recreation.

WATER SUPPLY/WATER USE DISTRIBUTION IN CALIFORNIA

(units in acre-feet)
1987



70% OF WATER

80% OF NEED

BA-II-C-114

Fig. 1

In looking at water distribution in California, there is a hierarchy of systems for the conveyance of water. This section of the report will deal with water systems beginning with the larger agencies and ending with the small agencies. There are generally three levels, or tiers, of water agencies as follows:

1. State and regional level agencies which operate the Aqueducts.

2. Sub-regional agencies which are water wholesalers.

3. Local agencies which are water purveyors or retailers.

Major water storage and transportation facilities have been constructed to distribute water where it is needed. The Sacramento-San Joaquin Delta is at the heart of the state's two major water projects, the State Water Project (SWP) and the federal Central Valley Project (CVP). Approximately 60 percent of all water diversions stem from the Delta as the CVP and SWP transfer fresh water supplies through the Delta from northern sources to central and southern consumers. An historic agreement between the state and federal governments in 1986 (the Coordinated Operation Agreement) provides for coordinated operations of the SWP and CVP, and gives additional safeguards to the fragile Delta. Fig. 2 indicates the major features of the SWP and CVP.

1. State and Regional Water Supply Systems

a. The Central Valley Project (CVP)

Construction of the CVP was started by the federal government during the Depression Era. Built by the Army Corps of Engineers and operated by the U.S. Bureau of Reclamation, the CVP's initial facilities were completed by 1951.

The project stores and transports surplus water of the Sacramento and San Joaquin Rivers for use primarily in the Central Valley for irrigation. The CVP consists of a number of major dams and canals beginning at Shasta Dam on the Sacramento River in Northern California and ending on the Kern River near Bakersfield. Current estimates of water delivery by the CVP are in the region of 6 to 8 million acre-feet per year (AFY).


Existing and Authorized
Major Features of the
State Water Project and
Central Valley Project
Clair Engle Lake
Shasta Lake
Whiskeytown Res.
Lake Oroville
SACRAMENTO RIVER
Feather River
Folsom Lake
Sacramento-San Joaquin Delta
New Melones Res.
Contra Costa Canal
SAN JOAQUIN RIVER
Delta Mendota Canal
San Luis Res.
California Aqueduct
San Bernardino County
Lake Silverwood
Lake Perris
LEGEND
State Water Project
Central Valley Project
Joint Use Facilities

Fig. 2

b. The State Water Project (SWP)

The first California Water Plan, published in 1957, recommended construction of the Feather River Project as the initial facility, which has become today's State Water Project. The SWP was authorized by the State Water Resources Development Act, or Burns-Porter Act, and was ratified by voters in 1960. Works specified in a $1.75 billion bond issue included dams and reservoirs, several aqueducts (including a major conveyance system to carry water from the Delta southward), levee improvements and facilities for transfer of water across the Delta, the joint use San Luis project (SWP and CVP), drainage facilities for the San Joaquin Valley, and electric and local water facilities. To date, the initial facilities of this huge system have been completed, with the exception of the Delta transfer facilities, drainage facilities, an aqueduct to serve the Central Coast, and some local projects.

Operated by the State Department of Water Resources, the SWP begins at Oroville Dam (the largest facility) on the Feather River in Northern California and ends at Lake Perris in Riverside County. The project today consists of 22 dams and reservoirs, 15 pumping plants, six power plants, the 444-mile California Aqueduct and 96 miles of branch aqueducts. The SWP has contracts to ultimately deliver 4.2 million AFY of water to its member agencies; current deliveries are about 2.5 million AFY. Thirty agencies statewide, of which the Metropolitan Water District of Southern California (MWD) is the largest, contract with the State Department of Water Resources for project water. There are 13 Southern California SWP contractors, with contracts for ultimate deliveries of 2.5 million AFY, or approximately 60 percent of the total. Most contractors will gradually reach their maximum annual entitlement around 1991. In order to meet contractual commitments, additional water projects will be required or commitments will have to be scaled down. The contractors, however, would vigorously oppose reductions in their entitlements and view that measure as an unacceptable alternative.

The early 1970's saw the completion of the initial facilities of the SWP (Oroville Dam, San Luis Dam, California Aqueduct, and pumping plants). These facilities provided a dependable supply of

approximately half the water the SWP contracted to ultimately deliver. Estimates for the year 2010 indicate that approximately 1.35 million AF will be available for the Southern California SWP contractors.

In the period since the completion of the SWP's initial facilities in the early 1970's, no new additional facilities have been constructed to increase water delivery capabilities, as originally conceived. During this period, the contractors' needs for SWP water have increased. The 1976-77 drought made it impossible for the SWP to meet contractor's requests for water. For Southern California sufficient Colorado River water was available to meet nearly all needs. However, this is no longer possible due to increasing demands in Southern California and the reduction of dependable supplies from the Colorado River with operation of the Central Arizonia Project.

Joint-use facilities of the CVP and SWP at San Luis Dam, reservoir and canal in Central California are a key link in the California Aqueduct and in the delivery of water to Southern California; this provides an example of state and federal coordination in the complex water distribution system in California.

c. Los Angeles Aqueducts

The first conveyance facility to bring water to the Southern California coastal plain was the Los Angeles Aqueduct. The original Los Angeles Aqueduct was built from 1908 to 1913, and diverts water flowing toward Owens Dry Lake some 250 miles south to Los Angeles. The aqueduct was extended north in 1940 by 105 miles to Mono Basin to capture water flowing into saline Mono Lake. A second Los Angeles Aqueduct was completed in 1970 which parallels the original aqueduct.

A total of 470,000 AFY is the average current supply via the Los Angeles Aqueducts, with 370,000 AFY from the Owens Valley and 100,000 AFY from the Mono Basin. During a prolonged dry spell such as the 1947 to 1952 dry period, 415,000 AFY would be available.

The continued ability of the Los Angeles Aqueducts to supply 470,000 AFY on average is uncertain as there is current litigation aimed at reducing both

the Mono Basin and Owens Valley sources of
for Los Angeles.

d. Colorado River Aqueduct

The Colorado River Aqueduct was the second m
conveyance facility to deliver water to the coa
plain. The Metropolitan Water District of Soutl
California (MWD) was formed to organize
construction of the Aqueduct. The 242 mile-l
Colorado River Aqueduct was completed in 1941
subsequently expanded to its present capacity.

Two Southern California SWP contractors have wat
supply contracts with the U.S. Bureau of Reclamati
(USBR) for Colorado River water -- MWD and t
Coachella Valley Water District (CVWD). Dependab
supplies to these contractors have been reduc
from 1.73 million AFY to approximately 800,000 A
now that the Central Arizona Project is divertir
Colorado River water to Phoenix and Tucson.

MWD formerly had the right to divert 1.212 millio
AFY from the Colorado River. Deliveries to th
Central Arizona Project have reduced
dependable Colorado River supply to less
550,000 AFY. Current use of water by holders of
present perfected rights (Indian Reservations,
cities, towns, and individuals with historic
rights) reduce MWD's supply by 30,000 AFY to
520,000 AFY. Conveyance losses along the Colorado
River Aqueduct of approximately 50,000 AFY further
reduce the dependable water supply reaching the MWD
service area to 470,000 AFY.

2. Sub-Regional Water Distribution Systems

As previously indicated, the State of California
contracts with 30 water agencies for delivery of State
Water Project (SWP) water. In the Southern California
region, which includes the County of San Bernardino,
thirteen water agencies have contracts with the State.
Fig. 3 indicates the area served by Southern California
SWP contractors in addition to the major aqueducts
described on the preceding pages.

The thirteen Southern California water contractors have
a maximum entitlement to 2,497,500 AFY of water. This
represents approximately 60 percent of the total SWP
maximum entitlement of 4,217,786 AFY. The estimated
population in 1986 of the thirteen water contractor
service areas is 14.8 million, or approximately 55

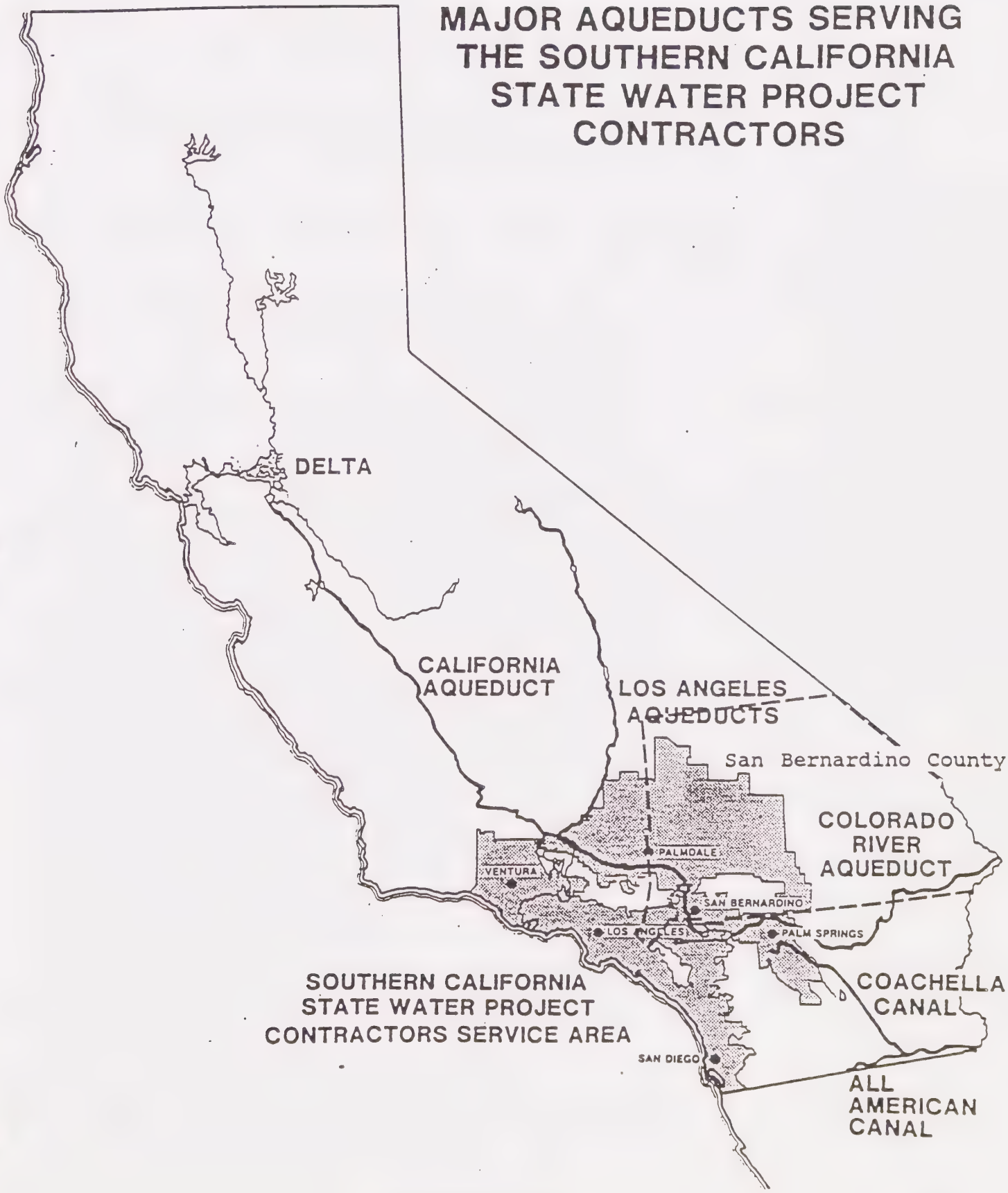

MAJOR AQUEDUCTS SERVING THE SOUTHERN CALIFORNIA STATE WATER PROJECT CONTRACTORS
DELTA
CALIFORNIA AQUEDUCT
LOS ANGELES AQUEDUCTS
San Bernardino County
COLORADO RIVER AQUEDUCT
PALMDALE
VENTURA
SAN BERNARDINO
LOS ANGELES
PALM SPRINGS
SOUTHERN CALIFORNIA STATE WATER PROJECT CONTRACTORS SERVICE AREA
COACHELLA CANAL
SAN DIEGO
ALL AMERICAN CANAL

Fig. 3

percent of the State population of 27.0 million as estimated by the State Department of Finance.

It is estimated that water consumption within San Bernardino County is approximately 453,000 AFY, with approximately 69% accounted for in urban use and 31% for agricultural use (SCAG, 1986).

In the County of San Bernardino, there are three SWP contractors and one subcontractor which serve areas wholly within the county:

- Crestline-Lake Arrowhead Water Agency (CLAWA)
- Mojave Water Agency (MWA)
- San Bernardino Valley Municipal Water District (SBVMWD)
- Chino Basin Municipal Water District (CBMWD), which is a member agency, or subcontractor, of the Metropolitan Water District of Southern California (MWD)

The areas served by the above water agencies have an estimated combined population of 1,051,000 (1987), which accounts for 87% of the County's total population of 1,202,000 as estimated by the State Department of Finance (July 1,1987).

a. Crestline-Lake Arrowhead Water Agency (CLAWA)

CLAWA covers an areas of approximately 55,000 acres (86 square miles) along the crest of the San Bernardino Mountains, and includes the communities of Crestline, Cedar Pines Park, Valley of Enchantment, Rimforest, Blue Jay, Arrowbear, Green Valley Lake, Running Springs, Skyforest, and Twin Peaks (see Fig.4). CLAWA was established in 1962 by the California Legislature and approved in 1963 by local voters. Lake Arrowhead and the surrounding lands are not a part of CLAWA by choice of the private company owning that development in 1963. The Big Bear Valley and Wrightwood mountain areas are also not a part of CLAWA.

The permanent population of CLAWA is estimated at 18,000 (1986), but there is a substantial influx of visitors and seasonal residents.

CLAWA is primarily a water wholesaler of SWP water for urban use to approximately 30 retail water purveyors, both public and private. There are also three improvement districts in which CLAWA acts as a water retailer directly to customers.

CRESTLINE-LAKE ARROWHEAD WATER AGENCY

WATER TANK SITES & PIPE LOCATION MAP

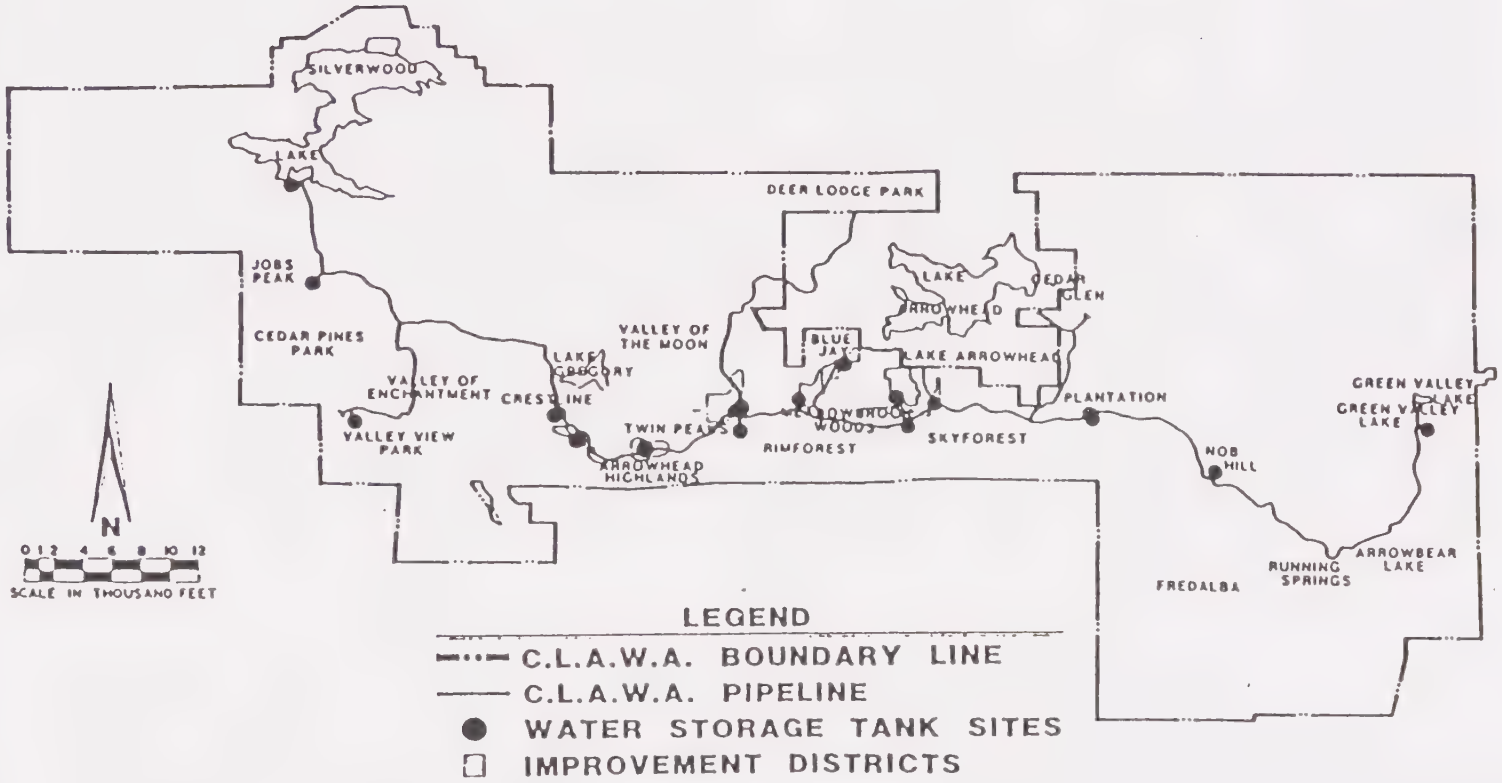


Fig. 4

The agency supplied approximately 1,250 AF of water in 1986, 85% of which was wholesaled and 15% retailed to residential customers. CLAWA's 1987 entitlement to SWP water was 4,930 AF; the full entitlement of 5,800 AF will be reached in 1990. The agency's entitlement includes enough to supply the Lake Arrowhead Community should it desire to obtain supplemental water from CLAWA.

Water demand is projected to increase to approximately 3,100 AFY by 2000, and the wholesale/retail mix is expected to remain essentially the same.

Water wells, springs, and lakes were used exclusively to supply water prior to the formation of CLAWA. However, groundwater sources in the area are limited. The first deliveries of SWP water to CLAWA were in 1972, and currently most of the water used comes from this source. SWP water is pumped directly from Lake Silverwood by CLAWA to its treatment plant and into the distribution system.

b. Mojave Water Agency (MWA)

Situated in the Mojave Desert, MWA is 3,160,400 acres (4938 sq. miles) in area. Included within the MWA service area are the cities of Adelanto, Barstow, and Victorville, and the unincorporated communities of the Victor Valley area (Apple Valley, Hesperia, Lucerne Valley, Phelan, Pinon Hills, Oak Hills, Baldy Mesa, Helendale, and Oro Grande), the Barstow area (Daggett, Newberry Springs, Yermo, Lenwood and Hinkley), and Joshua Tree, Yucca Valley, and Landers Fig. 5 illustrates the MWA area and its seven divisions.

The current population (1987) is estimated at 168,000, most of which are residents of the above cities and communities. The population growth rate is high, especially in the Victor Valley area.

MWA was formed by the California Legislature in 1960. Its primary purpose is contracting for SWP water, but has further authorization to develop, protect, and conserve water, to acquire water rights for beneficial purposes, and to construct, operate, and maintain hydroelectric works. At present MWA has no facilities to distribute the SWP water to which the agency has an entitlement.

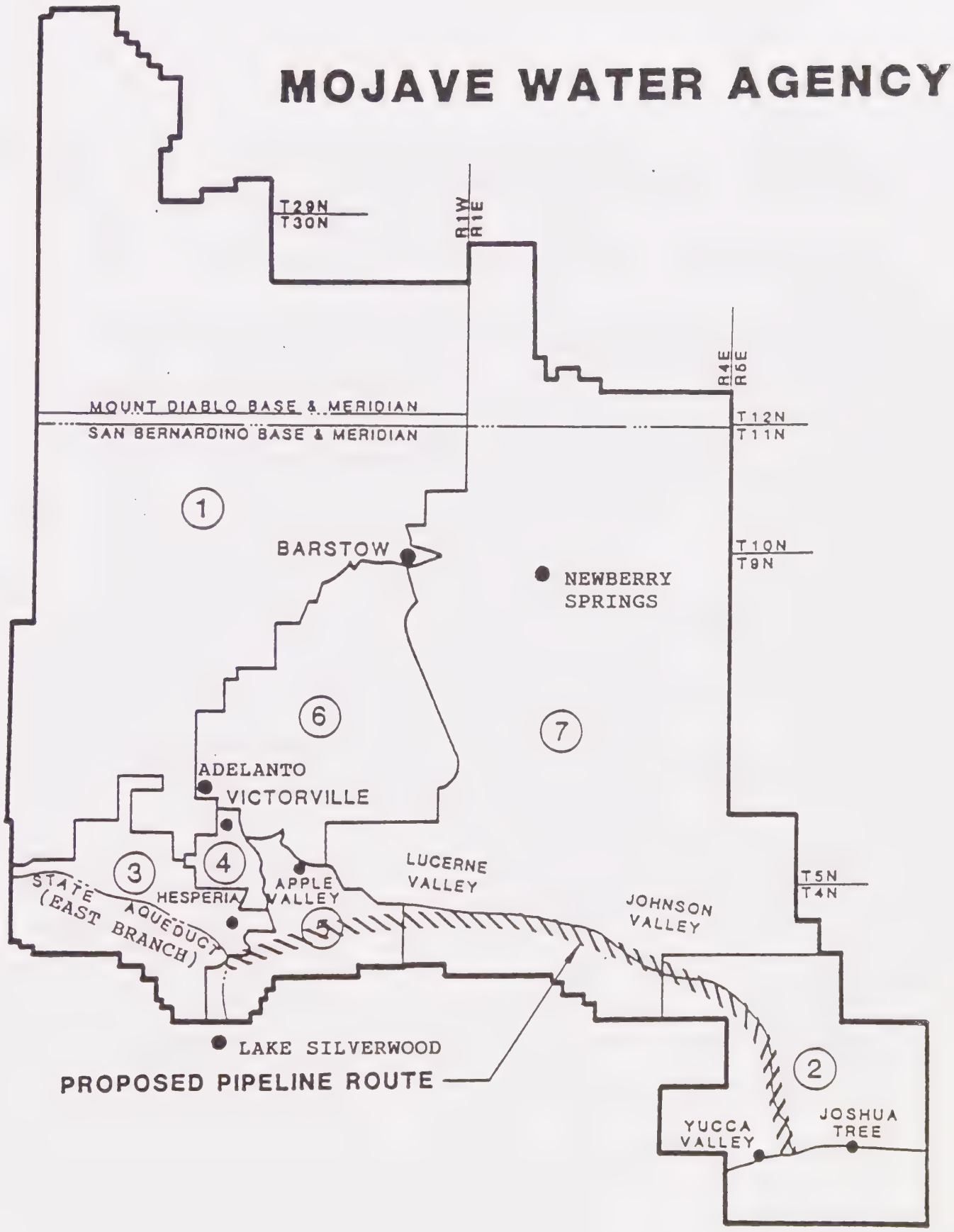

MOJAVE WATER AGENCY
T29N
T30N
R1W
R1E
R4E
R6E
MOUNT DIABLO BASE & MERIDIAN
SAN BERNARDINO BASE & MERIDIAN
T12N
T11N
T10N
T9N
T5N
T4N
1
BARSTOW
NEWBERRY SPRINGS
6
7
ADELANTO
VICTORVILLE
3
4
5
HESPERIA
APPLE VALLEY
LUCERNE VALLEY
JOHNSON VALLEY
STATE AQUEDUCT (EAST BRANCH)
LAKE SILVERWOOD
PROPOSED PIPELINE ROUTE
2
YUCCA VALLEY
JOSHUA TREE

Fig. 5

The first delivery of SWP water to MWA was in 1972, and the most recent delivery was in 1982. The water was delivered via the East Branch of the California Aqueduct, which runs through the MWA area to Lake Silverwood, and was used for groundwater recharge of the Mojave River Groundwater Basin.

Local water needs are met entirely by groundwater pumping of the many wells in the area's groundwater basins. The basins include the Upper, Middle, and Lower Mojave River Basins, the Harper Basin, the Coyote Basin, the Caves Canyon Basin, the Troy Basin and the Warren Basin. The Mojave River is the main drainage system for the San Bernardino Mountains' northeastern slopes, and provides the only groundwater recharge mechanism within the river basin. Current and past studies have indicated that the Mojave River basins are being overdrafted in excess of the MWA's maximum entitlement of 50,800 AFY of SWP water in 1990.

Many of the groundwater basins within the MWA area are considered to be in a serious state of overdraft, and general recognition of the problem is lacking. MWA projects deficits of 100,000-150,000 AF (SCAG, 1986) annually by the year 2000. Despite declining groundwater levels there will continue to be a reliance on groundwater until a local water distribution system is constructed to utilize SWP water.

MWA has been concerned with the overdraft of the Mojave River Basins for a considerable time. The agency filed for adjudication proceedings in 1966 due to concern about the long range issue of water supply. There was considerable opposition and the adjudication proceedings were dropped in 1974.

The Warren Groundwater Basin in the Yucca Valley/Joshua Tree area is the only adjudicated basin within the MWA. Adjudicated in 1977, the court judgement stated that "groundwater supplies of the Basin are sufficient to meet the needs of the projected overlying population only until about the period 1990 to 2000. Supplemental water will, accordingly, be required to meet water demands of the Basin in future years." Numerous studies have been done to determine water supply alternatives for the area, and a Morongo Basin Joint Power Authority has been established. The most cost-effective solution is a 70-mile pipeline from

the Hesperia Turnout of the California Aqueduct to Yucca Valley; this proposed project is currently being studied by MWA and the Morongo Basin Joint Power Authority.

c. San Bernardino Valley Municipal Water District (SBVMWD)

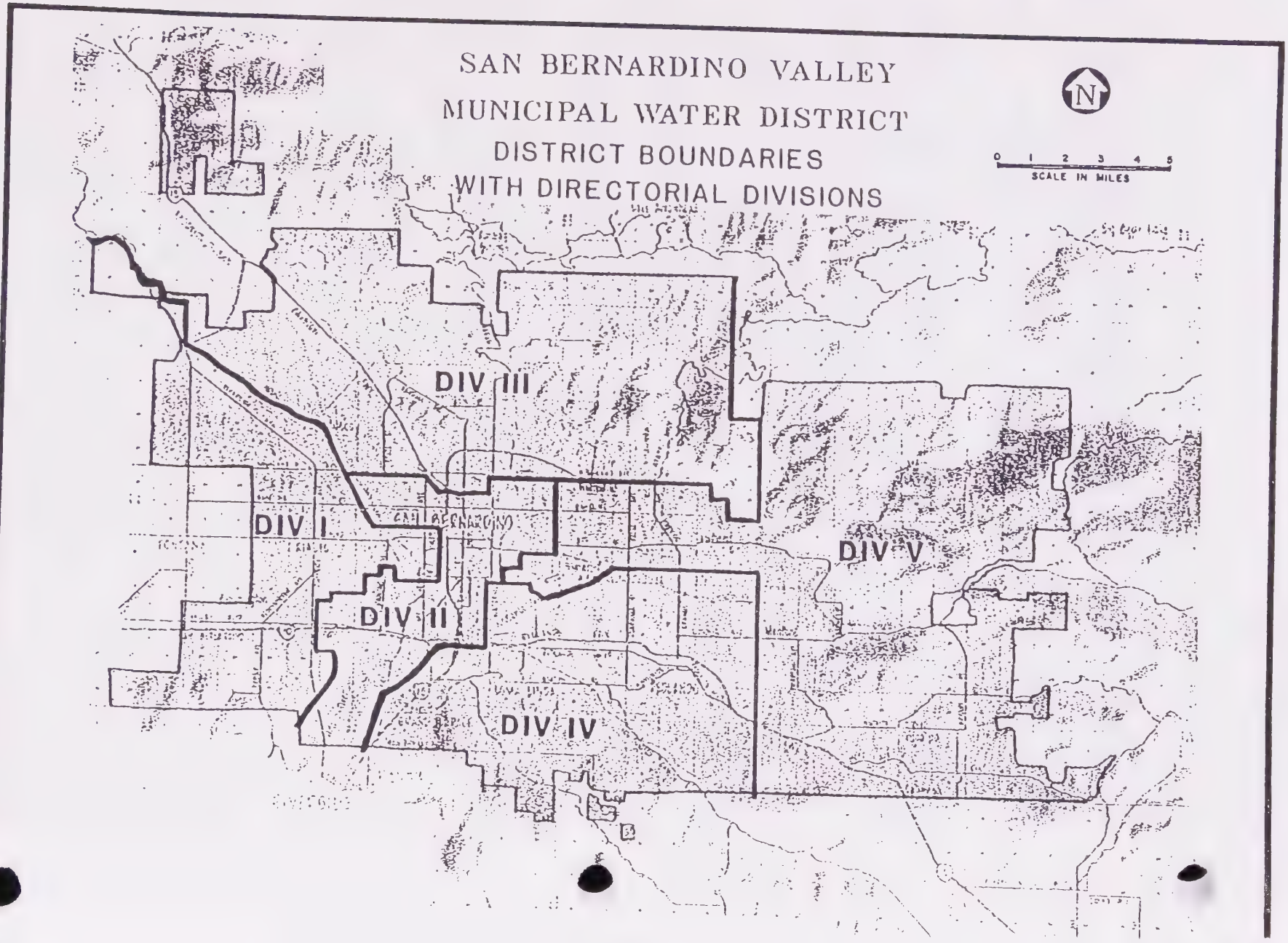
Formed in 1954, SBVMWD covers approximately 328 square miles in the East Valley planning area. The population is approximately 410,000 (1987). Included in the area are the cities of San Bernardino, Colton, Loma Linda, Redlands, Rialto, Highland, and Grand Terrace; the area also includes the unincorporated communities of Yucaipa, Mentone, Crafton, East Highlands, Bloomington, Muscoy and Devore (see Fig. 6). SBVMWD's tasks include:

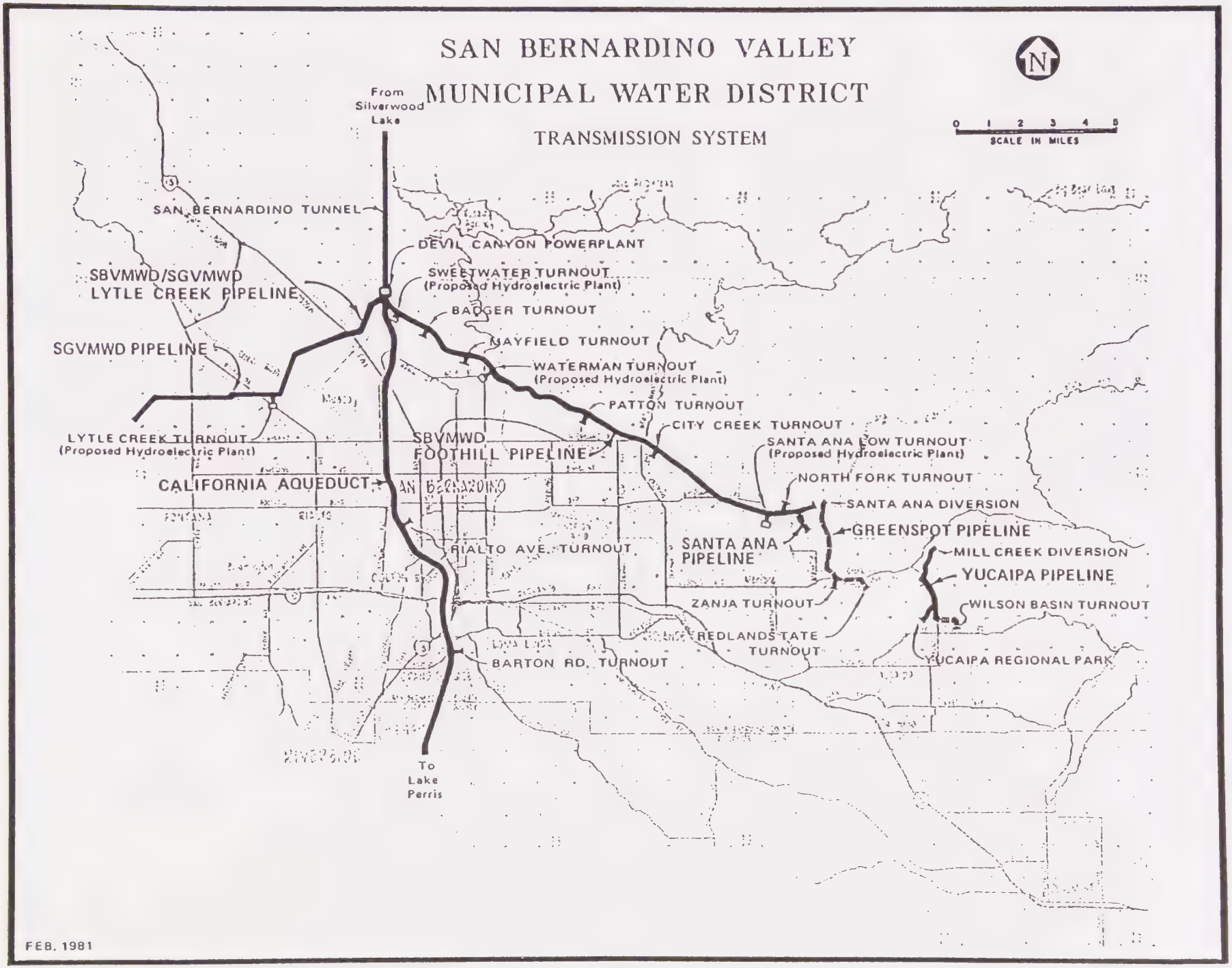
- development of long-range water supply plans
- acquisition of supplemental imported water
- responsibility for maintaining court-adjudicated water levels in the Colton-Rialto groundwater basin
- providing replenishment water to the San Bernardino Basin area

SWP water is delivered to SBVMWD at the Devil Canyon Power Plant on the California Aqueduct's East Branch, and is conveyed eastward via a 17-mile Foothill Pipeline which delivers the water for downstream spreading and agricultural uses. Another pipeline extends west from Devil Canyon and is used jointly by SBVMWD and San Gabriel Valley Municipal Water District for groundwater recharge in the Colton-Rialto area. Fig. 7 illustrates SBVMWD's major facilities.

SBVMWD contains 11 major retail water purveyors, including five cities, four water districts and two water companies, in addition to numerous small water purveyors. Groundwater is the principal water source in SBVMWD's service area, supplemented by retail agencies' surface water diversions.

Groundwater levels have significantly recovered from low levels experienced in the mid-1960's as a result of changed pumping patterns, replenishment activities, and recent high rainfall. The Bunker Hill Basin, which is the principal groundwater basin, has returned to pre-1950 levels. An exception is the Yucaipa Basin, which has


SAN BERNARDINO VALLEY
MUNICIPAL WATER DISTRICT
DISTRICT BOUNDARIES
WITH DIRECTORIAL DIVISIONS
N
0 1 2 3 4 5
SCALE IN MILES
DIV III
DIV I
DIV II
DIV IV
DIV V



BA-II-C-128

Fig. 7

experienced slower recovery. Yucaipa's di
from SWP water sources and higher elev
removes the area from an economical supple
water supply. However, a complex exchange
has been developed by SBVMWD to divert local
elevation runoff for groundwater replenishmer
replacing the water from other sources to downs
holders of water rights.

The Bunker Hill Groundwater Basin is the la
in the SBVMWD area, and is being considere
conjunctive use with SWP water and facili
However, high groundwater levels, which beg
1980, make it impractical to impleme
comprehensive conjunctive use program u
agreement is reached on how to manage
groundwater levels in the Bunker Hill Pre
subarea in the southern portion of San Berna
City.

Population growth projections in the District
based on estimates by the Southern Califo
Association of Governments (SCAG) 1982 Gr
Forecast Policy, and are as follows:

Year	Population
1990:	446,100
2000:	522,000
2010:	591,000

Water use projections for the SBVMWD area indic
a steady increase in municipal and industr
(M&I) water use and a steady decline in agricultu
water use. M&I use projections assumed
significant change in per capita water use, wh
is currently .2692 acre-feet per person per y
(AFPY), or approximately 240 gallons per per
per day. The following indicates the 1980 wa
use and projections in ten year increments to
year 2010 for the SBVMWD area in AF:

1980 and Projected Total Water Use in SBVMWD in 1,000 AF

	1980	1990	2000	2010
Municipal/Industrial	94.2	120.4	141.1	159.9
Agricultural	48.7	30.6	14.6	4.8
TOTAL	142.9	151.0	155.7	164.7

SBVMWD reaches its maximum annual entitlement of 102,600 AF of SWP water in 1991. The first imports of SWP water were in 1972. Since then, most of the imported water has been used for recharge of the Bunker Hill Basin and, to a lesser extent, the Colton-Rialto Basin. At present the district is taking only a small portion of its SWP water entitlement (9,000 AF in 1985) due to the over abundance of local groundwater.

Local surface water diversions from streams are an important source of supply. The District has an extensive network of diversion facilities on Mill Creek, Lytle Creek, and the Santa Ana River. Diversions within the District amounted to 49,700 AF in 1980.

Groundwater pumping also contributes to the District's needs as well as the needs for a major portion of the City of Riverside in Riverside County. SBVMWD does not operate any wells within the District; this function is carried out by the individual water retailers. The following four groundwater basins are in the District's area, and groundwater extractions for 1980 are indicated:

Colton-Rialto	28,272 AF
Bunker Hill	81,870 AF
Bunker Hill Pressure	71,925 AF
Yucaipa	4,485 AF
TOTAL	186,552 AF

Two court cases have affected future water obligations for SBVMWD, the Orange County Water District Case and the Western Municipal Water District of Riverside County Case. The Orange

County Case, settled in 1969, specified that SBVMWD be responsible for delivery of an average annual adjusted base flow of 15,250 AF in the Santa Ana River at Riverside Narrows. The Western Case was also settled in 1969. Under the terms of this judgement, SBVMWD is obligated to provide imported water for replenishment of the San Bernardino Basin area at least equal to the amount by which extractions from the Bunker Hill Basin for use in San Bernardino County exceed those during the five year period 1959-63, "adjusted as may be required by the natural safe yield of the San Bernardino Basin Area...." In addition, SBVMWD is responsible for maintaining water levels in the Colton Basin area.

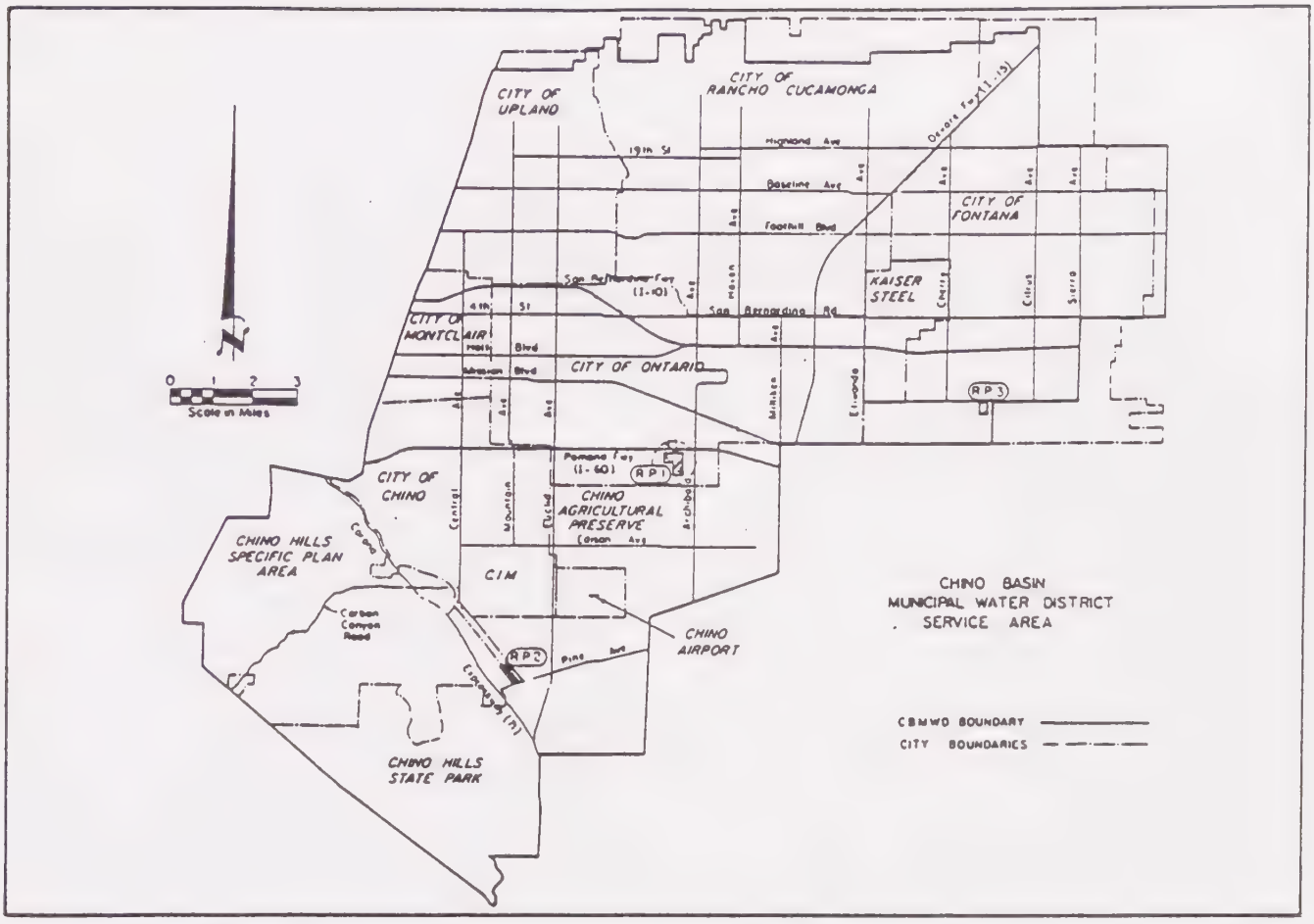
In relation to the above judgments, the assessment of SBVMWD's obligation for replenishment water in the Bunker Hill Basin ("San Bernardino Basin area") and base flow requirements at Riverside Narrows is prepared by the Western San Bernardino and Santa Ana River Watermasters, respectively. These watermasters are court-appointed, and are responsible for implementing and reporting on their judgements.

Municipal and industrial water use in 1986 accounted for approximately 75 percent of total water demand in the District. Due to the nature of urban development, which has been generally low density within the District and requires less water than the agricultural uses it has replaced, there was a general decline in water requirements during the 1960's and early 1970's. This trend is expected to continue.

d. Chino Basin Municipal Water District (CBMWD)

CBMWD occupies approximately 242 square miles in the extreme southwest portion of the County, which comprises the West Valley planning area. The population of the area is estimated at 455,000 (1987). The district is one of 27 member agencies of the Metropolitan Water District of Southern California (MWD), and is the only MWD member agency located in the County of San Bernardino. Fig. 8 indicates CBMWD's boundaries and facilities within the district.

MWD covers 5,130 square miles, and includes some 240 cities and unincorporated communities in six Southern California counties (San Bernardino,


CITY OF UPLAND
CITY OF RANCHO CUCAMONGA
CITY OF FONTANA
KAISER STEEL
CITY OF MONTCLAIR
CITY OF ONTARIO
CITY OF CHINO
CHINO AGRICULTURAL PRESERVE
CHINO HILLS SPECIFIC PLAN AREA
CIM
CHINO AIRPORT
CHINO HILLS STATE PARK
RP 1
RP 2
RP 3
Scale in Miles
CHINO BASIN MUNICIPAL WATER DISTRICT SERVICE AREA
CBMWD BOUNDARY
CITY BOUNDARIES

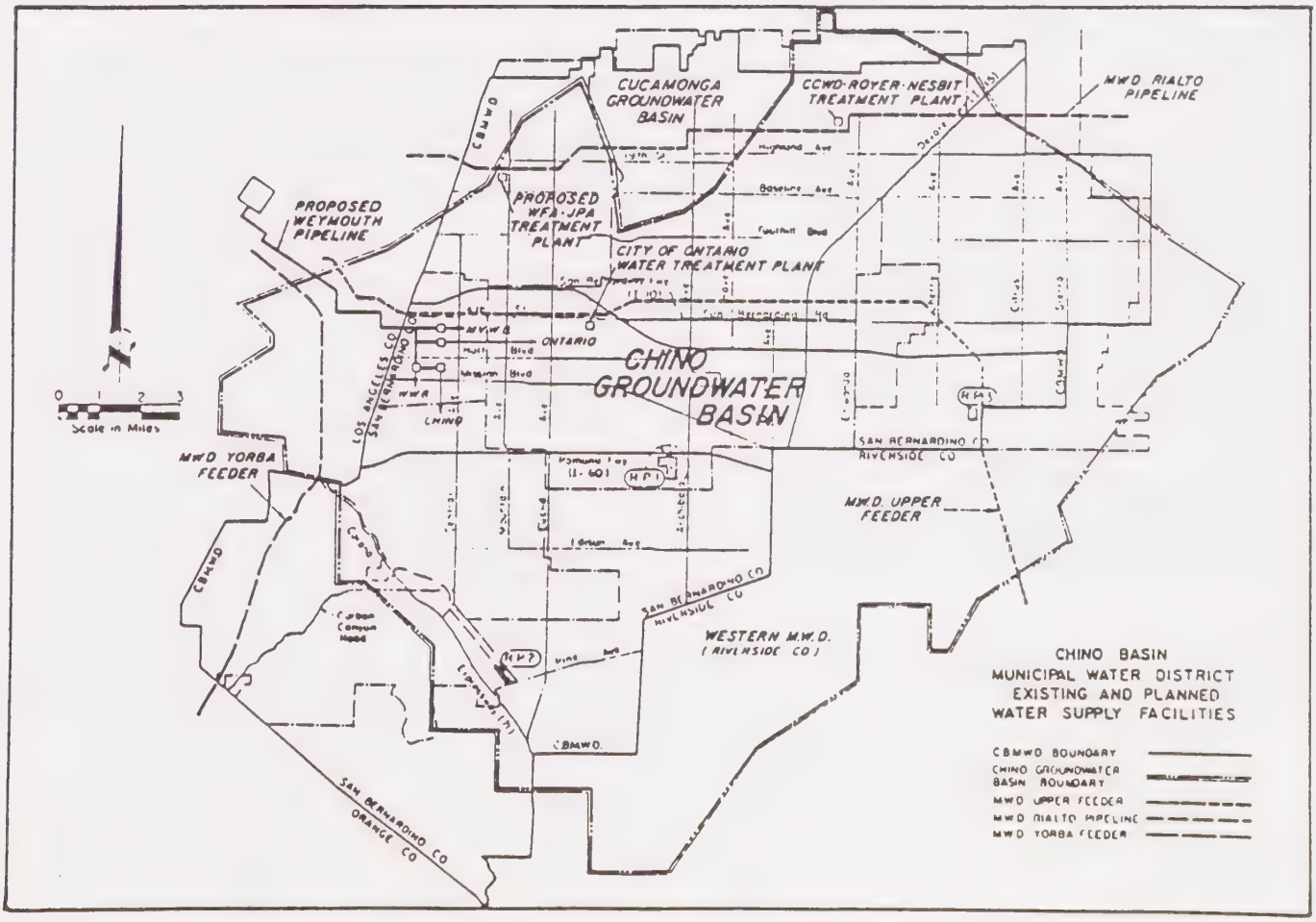

CUCAMONGA GROUNDWATER BASIN
CCWD-ROYER-NESBIT TREATMENT PLANT
MWD RIALTO PIPELINE
PROPOSED WEYMOUTH PIPELINE
PROPOSED WFA-JPA TREATMENT PLANT
CITY OF ONTARIO WATER TREATMENT PLANT
CHINO GROUNDWATER BASIN
MWD YORBA FEEDER
MWD UPPER FEEDER
WESTERN M.W.D. (RIVERSIDE CO)
SAN BERNARDINO CO
RIVERSIDE CO
ORANGE CO
CBMWD
Scale in Miles
CHINO BASIN MUNICIPAL WATER DISTRICT EXISTING AND PLANNED WATER SUPPLY FACILITIES
CBMWD BOUNDARY
CHINO GROUNDWATER BASIN BOUNDARY
MWD UPPER FEEDER
MWD RIALTO PIPELINE
MWD YORBA FEEDER

Fig. 8

Riverside, Los Angeles, Orange, San Di
Ventura). Established in 1928 by the Ca
Legislature and local public vote, MWD's
was to construct the Colorado River Aquedu
delivery system for water distribution
member agencies. MWD contracted with the
1960 for SWP water. Member agencies inc
cities, 12 municipal water districts, and on
water authority. The population of the MWD
areas is estimated at 13.7 million
representing approximately half the
population. MWD is the largest regional whc
of urban water supplies in the State.

CBMWD serves as a wholesale distributor of i
water from the Colorado River and SWP
cities of Ontario, Upland, Montclair,
Rancho Cucamonga, and Fontana, the Chinc
unincorporated area, the Chino Agricu
Preserve, and Chino Hills State Park. The
also acts as the court appointed Watermas
the Chino Groundwater Basin, which was adjuc
in 1978 as a result of declining water lev
the basin, and is now managed in accordanc
the court judgement.

Groundwater is the predominant water source
CBMWD, with the majority of groundwater ext
from the Chino Groundwater Basin, and to a
extent the Cucamonga Basin and other peri
basins. The Chino Groundwater Basin is est
to have 13 million acre-feet of storage ca
with estimated current storage (1987) of ap
mately 8.7 million acre-feet. The Cuca
Basin's capacity is estimated at 992,000
feet. Court judgments for the above basins
established annual safe yields of 140,000 AF
the Chino Groundwater Basin, and 22,721 AF
the Cucamonga Basin. Peripheral basins supp
average collective yield of approximately 2
AFY. Surface water from streams in the
Gabriel Mountains account for an average yie
approximately 20,000 AFY, this source, how
would be the first to go dry in a prolonge
period. The above water supply sources w
CBMWD account for approximately 203,000 AFY.
annual water demand in 1985 was 235,000 AFY,
the shortfall of 32,000 AFY being made up
imported water supplies.

The Chino Basin's 140,000 AFY safe yield is allocated under the judgement among three "pools" or categories of water users as follows:

Pool	Entitlement
Agricultural	82,800 AFY
Non-Agricultural (large-scale industrial users) ...	7,366 AFY
Appropriative (urban area water retailers) ...	49,834 AFY
Total Safe Yield	140,000 AFY

The Appropriative category consists of the following seven retail water purveyors who supply water to CBMWD's urban areas:

	Agency	Area of Service
1.	City of Chino	City of Chino
2.	City of Ontario	City of Ontario
3.	City of Upland	City of Upland
4.	Monte Vista Water District	City of Montclair
5.	Cucamonga County Water District	City of Rancho Cucamonga
6.	San Bernardino County Water Works District No. 8	Chino Hills unincorporated area
7.	San Gabriel Valley Water Company, Fontana Division	City of Fontana

Non-Agricultural water producers are mainly large scale industrial users who provide their own water supply from wells rather than receiving water from one of the water purveyors in the Appropriative category.

The Agricultural category entitlement to groundwater from the Chino Basin is by far the largest of the three categories of water users, due to the Chino Agricultural Preserve which is within the basin. However, both current and projected water use indicate that the full entitlement will not be used, and the unused entitlement is transferable

to the retail urban water purveyors in the Appropriative category.

The 1985 water demand within the Chino Basin was 235,000 AFY, and is expected to increase to 310,000 AFY in the year 2000. CBMWD's existing (1985) and projected water use figures for the three water user categories are summarized below:

	1,000 AFY			
	1985	1990	1995	2000
Agricultural	60.0	59.0	58.0	57.0
Non-Agricultural (large scale industrial users)	5.7	5.8	5.9	6.0
Appropriative (urban area water retailers)	169.3	190.2	221.1	247.0
Total	235.0	255.0	285.0	310.0

The above table indicates a substantial increase in the overall total demand, which is primarily due to increased demand by the urban area water retailers. Additional water will therefore be required for the CBMWD service area. Imported water from the MWD will be the principal source. Other water sources are being developed through various water management and conservation efforts. These include:

- Public awareness programs on water conservation through the media, speaking engagements, brochures, films, and public school training in conjunction with MWD.

- Conjunctive use of the Chino Groundwater Basin with the State DWR and MWD. A groundwater storage program is being developed to recharge up to 700,000 acre feet of SWP water into the groundwater basin for use by MWD during critical dry periods and emergency or maintenance shut-downs on the SWP or Colorado River Aqueducts.

- Cyclic storage, an agreement between CBMWD and MWD in 1979, which spreads surplus imported water for recharge of the

groundwater basin for use in dry periods when imported water is limited.

- o Agricultural Pool transfers of the unused entitlement under the Chino Basin Judgement to the urban water retailers, which provides approximately 20,000 AFY during average water years.

- o Water reclamation and reuse for irrigation, groundwater recharge, and industrial uses.

- o Imported water rate structures, which makes surplus imported water available at reduced prices in order to conserve local supplies.

Five of the water purveyors in CBMWD's Appropriative Category have formed the Water Facilities Authority (WFA)-Joint Powers Agency. The WFA consists of the cities of Chino, Ontario, Upland; San Bernardino County Waterworks No. 8, and Monte Vista Water District. A water treatment plant in Upland was recently completed in mid-1988.

e. Southern California Water Committee

The Southern California Water Committee (SCWC) was established in 1985 by the eight Southern California Counties of San Bernardino, Riverside, Los Angeles, Orange, Imperial, Kern, San Diego, and Ventura. Founded as a non-profit, non-partisan organization, the committee seeks to increase public awareness and understanding of water issues. The SCWC has a membership of over 400 including county governments, cities, businesses, agriculture, and water agencies. A water policy for Southern California has been developed based on the following goals:

- o reliability of supply
- o preservation of quality
- o commitment to conservation
- o affordability

3. Local Agencies

The retail distribution of water in San Bernardino County is primarily handled by 88 water systems, which are regulated by the California Department of Health Services as large public water systems (200 or more connections). A further 300 water systems are regulated

by the San Bernardino County Department of Environmental Health Services as small public water systems (less than 200 connections).

Water distribution on a retail basis in San Bernardino County is carried out by a multiplicity of agencies, including city water systems, county water districts, mutual water companies, community service districts, privately owned water companies, and county special districts. These agencies have different operating motives, specifically, the profit motive for the private and investor owned companies and the not-for-profit operating principal of city and county systems and special districts.

In June, 1987, water agencies with large water systems regulated by the State Department of Health were sent letters with a view to obtaining information for the County's General Plan Update. The large-water systems in the Victor Valley area were excluded from the mailing list as a separate study was underway in that area. Additional information was obtained on these systems from the 1986 annual reports submitted to the State Department of Health. Pertinent information for the County's large water systems can be found in the Water Distribution Systems background report, which is part of the Master Environmental Assessment.

4. Local Areas of Concern

Problem areas at present in the supply and distribution of water include Wrightwood, the Big Bear area, Chino Hills, and Yucca Valley. It is intended that these areas along with any other problem areas may be looked at in greater detail as part of the proposed Infrastructure Needs Assessment Model. Wrightwood and the Big Bear area are not within the sub-regional State Water Contractors service areas and thus have no entitlement to SWP water to augment local supplies. Chino Hills and Yucca Valley, on the other hand, are within State Water Contractors service areas but are lacking distribution facilities.

Glossary

AF - acre-feet.

AFY - acre-feet per year.

CBMWD - Chino Basin Municipal Water District.

CLAWA - Crestline-Lake Arrowhead Water Agency.

conjunctive use program - use of a groundwater basin for storage of water by more than one agency.

CVP - Central Valley Project.

EHS - San Bernardino County Department of Environmental Health Service.

Infrastructure - The basic utilities and services necessary to support development, e.g., sewer, water, and roads, etc.

MWA - Mojave Water Agency.

MWD - Metropolitan Water District of Southern California.

SBVMWD - San Bernardino Valley Municipal Water District.

SCAG - Southern California Association of Governments.

SWP - State Water Project.

WFA - Water Facilities Authority-Joint Powers Agency, consists of the cities of Chino, Ontario and Upland; also San Bernardino County Waterworks No. 8 (Chino Hills), and Monte Vista Water District (City of Montclair).

GROUNDWATER SUPPLY AND QUALITY

"Whiskeys for drinkin, Waters worth fightin for"
Mark Twain

I. INTRODUCTION

Observations of a writer visiting our golden state almost 100 years ago continue to ring true today. Water is unarguably the most controversial and necessary resource in California. It has been transported throughout the State to support uses which otherwise might not have existed. The demand for water continues to grow as the population increases. Major growth areas, particularly in the southern portion of the state are already dependent upon imported water supplies to sustain existing populations. Aggravating the issue of deliverance of imported waters is the failure to fully complete several State wide-water projects, thus restricting the ability to provide contracted quantities to all users.

Natural replenishment of imported sources is wholly dependent upon rainfall and snowpack in mountain ranges in central and northern California. Periodically the State will go through wet and dry cycles, with the last official drought declared during the late 1970s. Current conditions seem to indicate that another dry year could result in similar water shortages necesitating mandatory conservation practices for the Southern California Region for 1989.

San Bernardino County faces these same water supply issues. Current and future projected growth will require adequate amounts of good quality water to meet this demand, imported water supplies along with better water conservation techniques must be secured and implemented. Recent supply and distribution concerns have resulted in defacto moratoriums in several communities across the County. Water supplies within the County are dwindling from continued overdrafting of the groundwater resources.

This section of the Background Appendix will present an opportunities and constraints analysis for water conservation within San Bernardino County. San Bernardino County contains many areas which are not utilizing imported waters and are wholly dependent upon local groundwater resources. Land use has a direct relationship to the quantity and quality of these waters. The interrelationships of water supply, quality and land use will be examined in order to provide data and analysis for the land use planner and decision makers involved with the General Plan Update.

Water supplies which originate and must be secured from outside of the County are discussed in the previously prepared Water Distribution Systems background appendix.

A. Definition

There is an old saying, "Water is where you find it." Fortunately we are not reliant upon guess work in locating water supplies. The location and supplies of groundwaters within San Bernardino County can be acticipated by reviewing pertinent surficial and subsurface geologic features; at least to some extent.

A discussion of the hydrologic cycle as it relates to San Bernardino County groundwater supplies and quality follows. It is hoped that with increased knowledge about local water resources more precise land use policies can be developed which will conserve existing and future locally available water supplies.

Groundwater management is a complicated field and involves the use of highly technical specialists. An objective of this section of the Background Appendix is to provide local planners with the necessary information to communicate with hydrogeologists in order to identify the need for groundwater protection and to design appropriate planning programs. Groundwater planning requires an understanding of some basic hydrogeologic terminology.

1. Groundwater occurrences

Groundwater is found in saturated soil and rock formations. This could be a uniform bedrock formation, sandstone for example, and is referred to as consolidated bedrock. Waters may also be captured in unconsolidated formations of sand, gravels, and silts. In consolidated and unconsolidated formations the porosity will determine the water storage capacity of a given formation. Porosity of the formation can be thought of as the space between the sand and rock particles. Permeability, often called hydraulic conductivity, refers to the rate at which waters move through the soils, or the capacity for transmission of waters. The location and volumes of water are directly tied to the soil and geologic conditions found both on the surface and subsurface.

2. Types of Aquifers

A formation that can yield usable amounts of water to a well is defined as an aquifer. An aquifer may be confined or unconfined. Surficial or unconfined aquifers are described as areas where unsaturated materials which are porous overlie a saturated formation. (See Figure 1.) In these cases the upper surface of the saturated zone is known as the water table. Generally the water table can be mapped by ascertaining the levels of wells tapping the surficial aquifer, and also they generally follow surface contour lines.

The second type of aquifer encountered in San Bernardino County is the confined aquifer. This is characterized by non-porous formations or confining beds which may overlie or underlie the aquifer. These impervious layers are often named aquatards and can consist of clays, shale or caliche. Waters in confined aquifers can often exceed atmospheric pressures. When this occurs, rising waters in wells will top the aquifer levels creating an artesian well condition. In some instances water will flow to the surface without pumping in the form of springs or seeps (See Figure 2).

The quantity of locally available groundwater depends upon the relationship between the flow of water into and out of the aquifer. Undisturbed aquifers exist in a state of dynamic balance between recharge, evapotranspiration, and discharge. Any remaining waters present themselves as surface flows and groundwater levels.

This balanced relationship in aquifers can be upset by man's activities. Groundwater levels are lowered in two principal ways, by reducing the amount of recharge to an aquifer and by the withdrawal of groundwater. Increasing groundwater levels can be achieved through artificially recharging the aquifer, or by restricting the rate of natural discharge.

Types of Aquifers

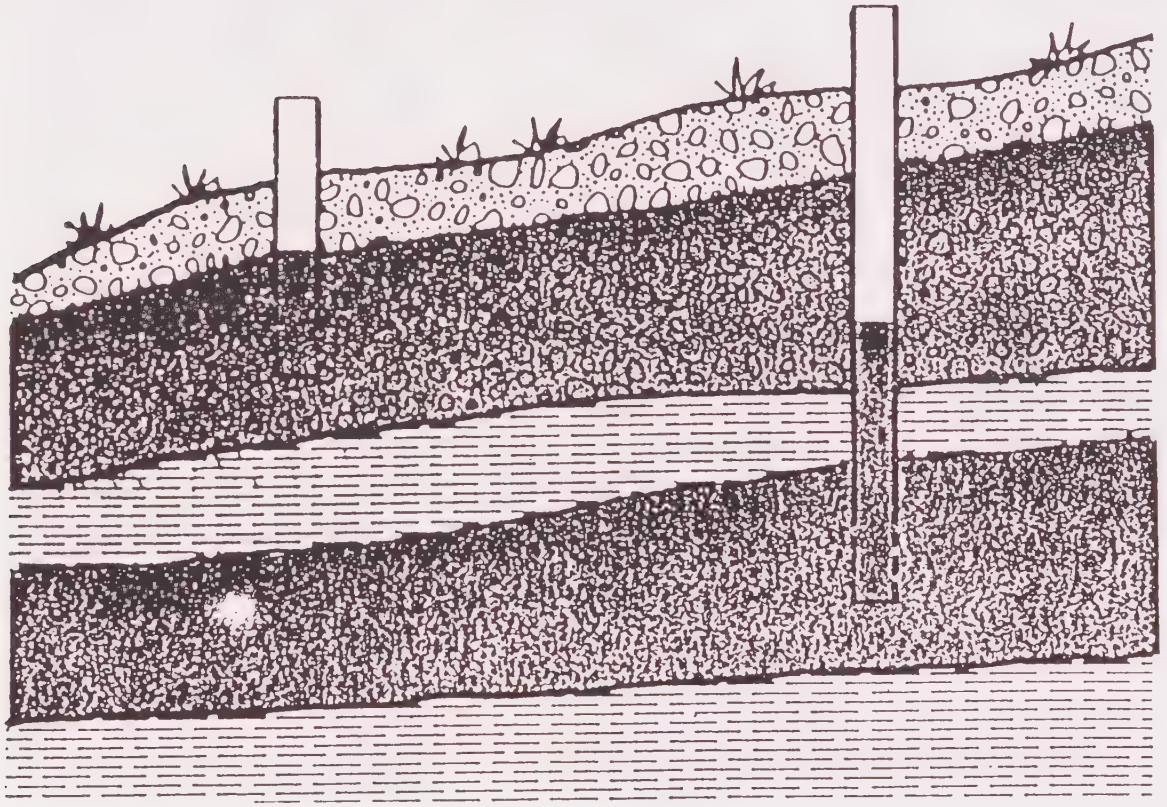
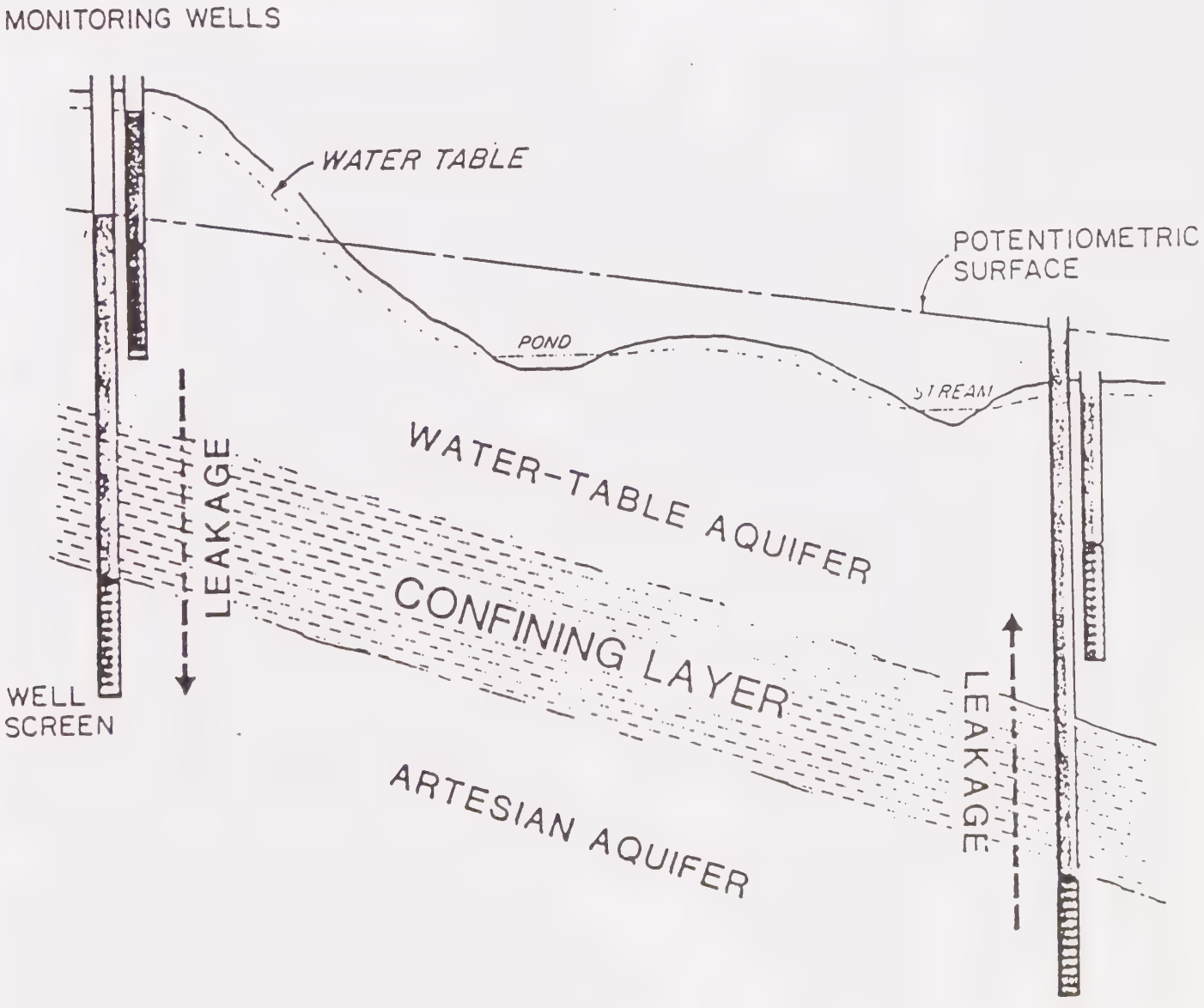


Fig. 1

Fig.2

Relationship Between Confined and Unconfined Aquifers



3. Groundwater Sources

Groundwater is defined as that portion of rainfall that does not evaporate, or runoff into streams and rivers, or transpire from plants. This water percolates down into the saturated zone of any given aquifer and is referred to as groundwater or aquifer recharge. Principally this recharge occurs in areas overlain with soils with higher permeability values. Recharge areas occur normally in the upland areas and drains to the lower portions of the basin. (See Table 1)

Each aquifer has its own characteristics in terms of amounts of water in storage and annual amounts of recharge. These features will determine the amounts of waters that may be safely extracted from any given aquifer. Groundwater management planning programs must take into account physical features. Usually this involves identification of the water environment through the delineation of sensitive areas, establishment of monitoring programs, regulation of the specific types and amounts of discharge introduced, and land use controls.

4. Precipatation

The amounts of water available for recharge differ widely dependent upon the location within San Bernardino county. Rainfall enters as recharge as it passes over areas with sufficient permeability. Snow pack may remain for months on impervious areas before it melts off and recharge occurs. However, as water ends its travel path and forms lakes, recharge becomes negligible and waters may eventually be lost to evaporation. See Figure 3 depicting the Mojave River Basin.

Most of San Bernardino County can be characterized as an arid environs, one with little natural water present on a regular basis. Average rainfall for most of the desert region is less than 4-6 inches per year for those areas below 3000 feet in elevation. This rainfall occurs in intense storms and therefore is not retained long enough for sufficient large quantities of recharge. It is estimated that fully 95% of the rainfall in the desert floor regions is lost to evaporation. Plant specimens will also transpire some of these waters leaving less than 5% of total rainfall occurring as recharge. Rainfall increases above the 3000 foot elevation to 8-10 inches per year. These areas represent higher recharge potential due to soil infiltration rates and greater quantities of waters.

Table 1

GEOLOGIC PERMEABILITY VALUES

ROCK TYPE	PERMEABILITY (M/DAY)	NOTES ON THE MOST COMMON CONTROL OF PERMEABILITY
Clay	<0.01	Very small pores
Silt	0.0001-1	Small pores
Loess	0.0001-0.5	Depending on texture and amount of cement
Fine sands	0.01-10	Depending on texture (pore size)
Medium to coarse sands	10-3,000	Depending on texture
Dune sand	2-20 (aver.8-10)	Depending on texture
Gravels	1,000-10,000	Large pores
Sand and gravel	0.3-10	Poorly sorted; fine grains plug large pores in gravel
Glacial outwash deposit	Up tp 1	Often poorly sorted. Up to 10m/day if very coarse and well sorted
Glacial till	0.001-10	Depending upon whether they are dense and silty ground tills, or sandy albation tiles
Sandstones and conglomerates	0.3-3	Size of intergranular pores, degree of cementation and of jointing
Crystaline, unjointed limestone	0.00003-0.1	Very few pores; jointed limestones, however, can have very large and variable permeability
Gabbro	>0.0003	Few pores; permeability depends on degree of jointing
Granites and granodiorites	0.0003-0.003	Depends on degree of jointing. Deeply weathered granitic rocks, however, can have permeabilities in the range 0.003-3 m/day
Volcanic tuffs	0.0003-3	Depends on depth of burial and compaction
Lavas	0.0003-3	Depends largely on degree of fracturing, but weathered surfaces may be highly permeable

(U.S.G.S.)

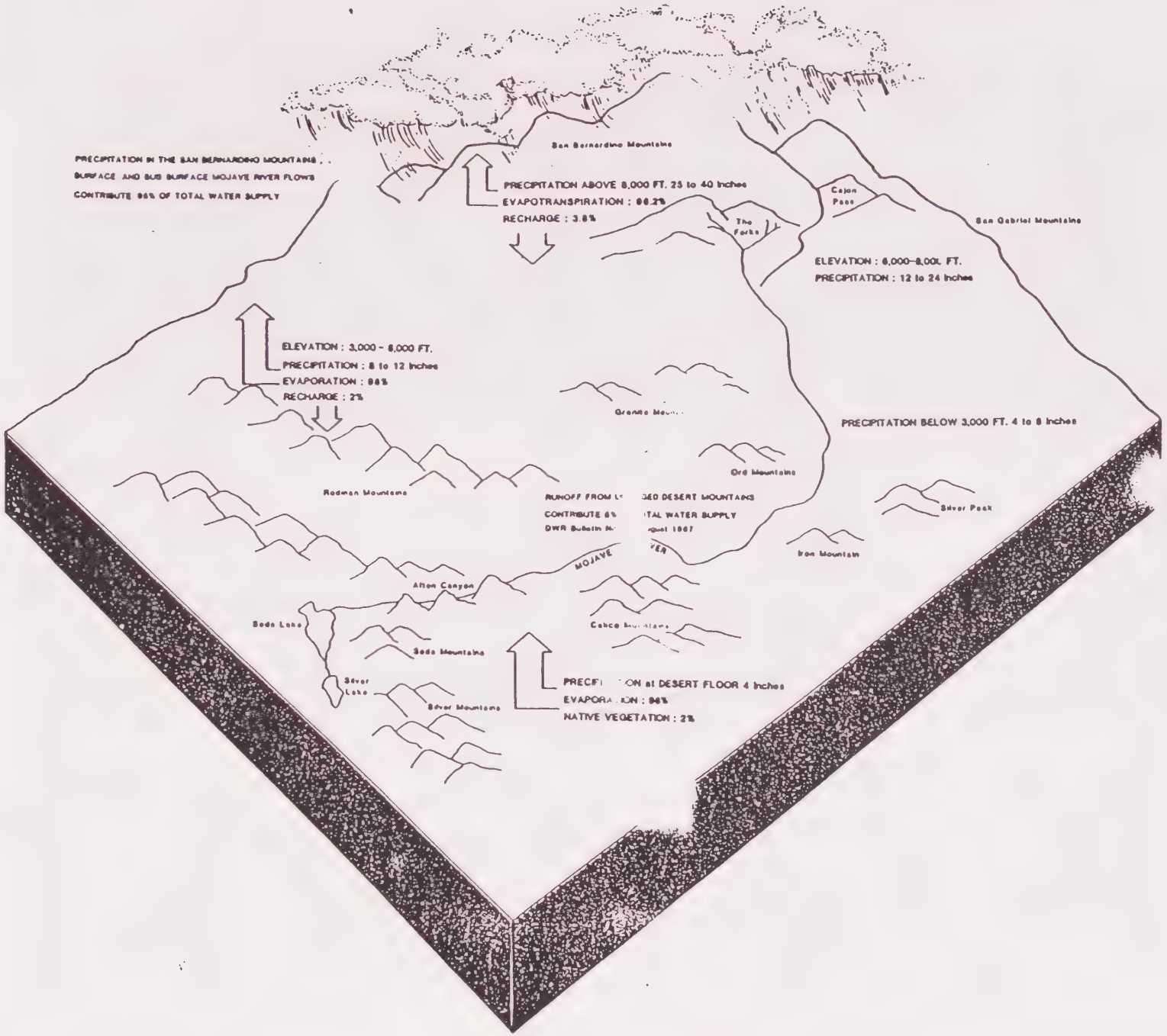

PRECIPITATION IN THE SAN BERNARDINO MOUNTAINS . .
SURFACE AND SUB SURFACE MOJAVE RIVER FLOWS
CONTRIBUTE 86% OF TOTAL WATER SUPPLY
San Bernardino Mountains
PRECIPITATION ABOVE 8,000 FT. 25 to 40 Inches
EVAPOTRANSPIRATION : 96.2%
RECHARGE : 3.8%
The Forks
Cajon Pass
San Gabriel Mountains
ELEVATION : 6,000–8,00[illegible] FT.
PRECIPITATION : 12 to 24 Inches
ELEVATION : 3,000 - 6,000 FT.
PRECIPITATION : 8 to 12 Inches
EVAPORATION : 98%
RECHARGE : 2%
Granite Mount[illegible]
PRECIPITATION BELOW 3,000 FT. 4 to 8 Inches
Ord Mountains
Rodman Mountains
RUNOFF FROM [illegible]ED DESERT MOUNTAINS
CONTRIBUTE 6% [illegible]TAL WATER SUPPLY
DWR Bulletin [illegible]quel 1967
Silver Peak
Iron Mountain
MOJAVE
Afton Canyon
Soda Lake
Cadiz Mountains
Soda Mountains
Silver Lake
Silver Mountains
PRECIPITATION at DESERT FLOOR 4 Inches
EVAPORATION : 98%
NATIVE VEGETATION : 2%

Fig.3

The mountainous areas, on the other hand, receive rainfall amounts of up to 85 inches per year. This principally occurs during the winter months as either snow or rainfall. While these waters do not fully contribute to recharge, a much larger proportion does recharge in the form of runoff. These waters will enter the fractured geologic rock formations and also runoff into well defined stream channels resulting in recharge. The mountains provide recharge for not only local communities but also for the valley and desert regions.

The valley portions of the county are influenced by coastal weather patterns and as such receive higher precipitation than the desert regions. Rainfall varies but usually approximates 10-15 inches per year. Large alluvial fans and other surface features are present for good recharge potential.

5. Surface Flows

The directional component of water and its flow determines the eventual location of waters either recharging or being lost. Waters are lost through evaporation from impoundment or directly from saturated soils, and transpiration from plants. Stream or river flows over the surface often define the path of water below the surface, especially when dealing with surficial aquifers. Perennial streams generally do not directly recharge ground water until they deposit them into a recharge area or spread out across alluvial areas. Intermittent streams on the other hand will display surface waters only temporarily due to the high infiltration rates found along the stream bottom. San Bernardino County is crisscrossed by this type of intermittent feature, particularly the Mojave and Santa Ana River courses.

Lakes and playas exist in part because their bottom features prohibit infiltration, usually due to clay, caliche or shale linings. Any percolation which does occur is due to leakage through the lake bottom aquatards. Numerous desert playas are found within San Bernardino County.

Alteration of surface flows has a direct impact on the amounts of rainfall that is available for recharge. As flows are concentrated through channeling in lined canals the natural recharge of surface features becomes lost. Creation of impervious surfaces also reduces the absorption properties of any given area, thus aggravating the loss of recharge or percolation. This will result

in reducing the amounts of water which may later be pumped for beneficial uses.

Alternatively, flows may also be retained, detained and denergized. Reducing flow volumes and velocity will allow saturation of recharge areas with minimum outflow. Erosion and deposition effects are also reduced. Water may be stored for future recharge, or possibly direct use. On site retention of storm flows can also enhance a site's recharge potential due to the infrequent nature of storms and their varing intensity.

Surface water features also provide a wide variety of other beneficial uses beyond recharge. Wildlife habitats, and recreational opportunities are all linked to maintenance of certain surface water features. Other sections of the Background Appendix will address the biological, recreational and flooding concerns with surface waters found in San Bernardino County.

6. Groundwater Quantity

The first extractions from any given aquifer will begin to upset its natural state of equilibrium. This is not a cause for alarm or concern unless the balance swings to an extreme and harming of the aquifer beyond repair occurs. The extraction of water from surface features may lower the volume of lake and downstream flows. Fortunately, few surface extractions of waters are occurring in San Bernardino County, so there is no need for great concern or extended further analysis.

Groundwater withdrawal is perhaps the largest hydrogeologic concern for water management planning agencies. Aquifers can yield enormous supplies of waters, unfortunately, they can also be depleted to render them virtually dry. The quantity of available water is dependent on two basic features: 1) The total storage capacity of the aquifer; and 2) the amount of usable capacity. The total storage capacity differs from the usable capacity. The usable capacity is defined as the amount of economically extractable waters and is always less than the total storage capacity.

Safe yield is defined by the Department of Water Resources as the rate of extraction equal to or less than the rate of natural recharge. Overdraft is the withdrawal of water greater than is replenished either naturally or artificially. Overdraft of an aquifer can occur for limited periods of time without adversely impacting the aquifer. That time period for which

continued overdraft can occur without permanent damage is wholly dependent upon the physical aquifer features, including overall storage capacity, usable capacity, porosity and permeability of the formation, and amounts of recharge.

There are a variety of adverse effects that can occur as a result of overdrafting an aquifer. If dewatering of aquifer soil pores takes place, shrinkage and compaction of sediments reduces the acceptance of percolating water, which reduces water storage ability. Decreased surface and subsurface flows can create an economic hardship on those drillers who will be forced to drill new and/or deeper wells. Lower flow volume also tends to reduce the density of riparian vegetation which provides food and shelter for wildlife. Ultimately, basin adjudication becomes necessary if individual pumpers cannot or will not control their water use voluntarily.

Extended periods of overdraft; also known as mining of an aquifer, can eventually degrade the porosity and permeability features and result in slumping or subsidence. Evidence of this can be seen in the east Lancaster area of Los Angeles County. Water quality levels will also decline. Salt and nitrate concentrations tend to increase as the amounts of water for sufficient dilution are depleted.

Establishing the usable capacity of an aquifer requires detailed investigations by hydrogeologists and is beyond the scope of this report. It is expected that these types of studies will be required in many of the basins within San Bernardino County. The Department of Water Resources and individual purveyors are currently the most likely agencies to perform these types of investigations.

Many aquifers are also suitable for increased introduction of waters for storage and subsequent use. This can occur as recharge through restricting aquifer discharge, capture of runoff, and introduction of imported supplies.

7. Groundwater Quality

Groundwater quality is often degraded by the geologic formations from which it is derived in San Bernardino County. Certain potable water supplies in the County have mineral concentrations above the recommended levels as set by Federal and State Health governing bodies. A brief discussion is included herein describing

the mineral constituents of concern and their re
health effects.

Nitrates in waters at concentrations in excess
milligrams per liter (mg/l) are of concern with r
to their use in preparing formulas for nursing inf
It has been found that the nitrates tend to inte
with their normal metabolism and may contribute
condition called infant methemoglobinemia (blue bab
Therefore, persons with wells located in areas sho
produce groundwaters with nitrates in excess of 45
should discuss the matter with local health authorit

The presence of fluorides in water supplies at exces
concentrations can also lead to dental fluor
(mottling of teeth). The potential for occurrence
mottled teeth has been found to relate to the t
amount of fluoride taken into the body. Thus, in a
where higher temperatures prevail and people tend
drink more water, lower concentrations of fluorides
required. For temperatures such as those that prev
in the County, health authorities have recommende
maximum of 1.4-2.4 mg/l for drinking water u
Persons obtaining their drinking water from area wh
produce groundwaters with high fluoride concen ti
should obtain further information in this regard f
local health authorities.

For this section, mineralized waters have been defi
as waters containing total dissolved solids (TDS)
excess of 500 mg/l, chlorides in excess of 250 mg/
sulfates in excess of 250 mg/l, or some combination
these. While such waters do not pose a hazard
health, they do tend to increase the amount of so
needed to launder clothes; they also may impa
undesirable mineral tastes and tend to reduce t
service life of hot water heaters, pipes, and fixture
through increased corrosion. When sulfates are prese
in high concentrations (above 500-600 mg/l) they ma
tend to have a laxative effect on new users, bu
acclimatization is usually rapid.

Boron concentrations in excess of 2.0 mg/l and chlorid
concentrations in excess of 350 mg/l are toxic to al
but the most salt-tolerant crops. Sodium in excessiv
amounts (for this report, 250 mg/l has been selected a
a criterion) tends to make the soil structure mor
compact and less permeable and water does not soak int
the ground. TDS concentrations in excessive amounts
tend to interfere with a plant's ability to remove ter
from the soil solution in the root zone. For the ps

currently grown in the County this has been found to be significant at a TDS level of 1000 mg/l.

A large portion of groundwaters within the boundaries of the County exhibit high TDS, fluoride, or nitrate concentrations, sufficient for concern and proactive planning policy. The water quality problems encountered are partially attributable to overdrafting.

8. Threats to Groundwater

Man's activities also have great potential to degrade potable supplies. Five of the more common and serious threats found within San Bernardino County are briefly discussed below. See Figure 4.

a. Landfills

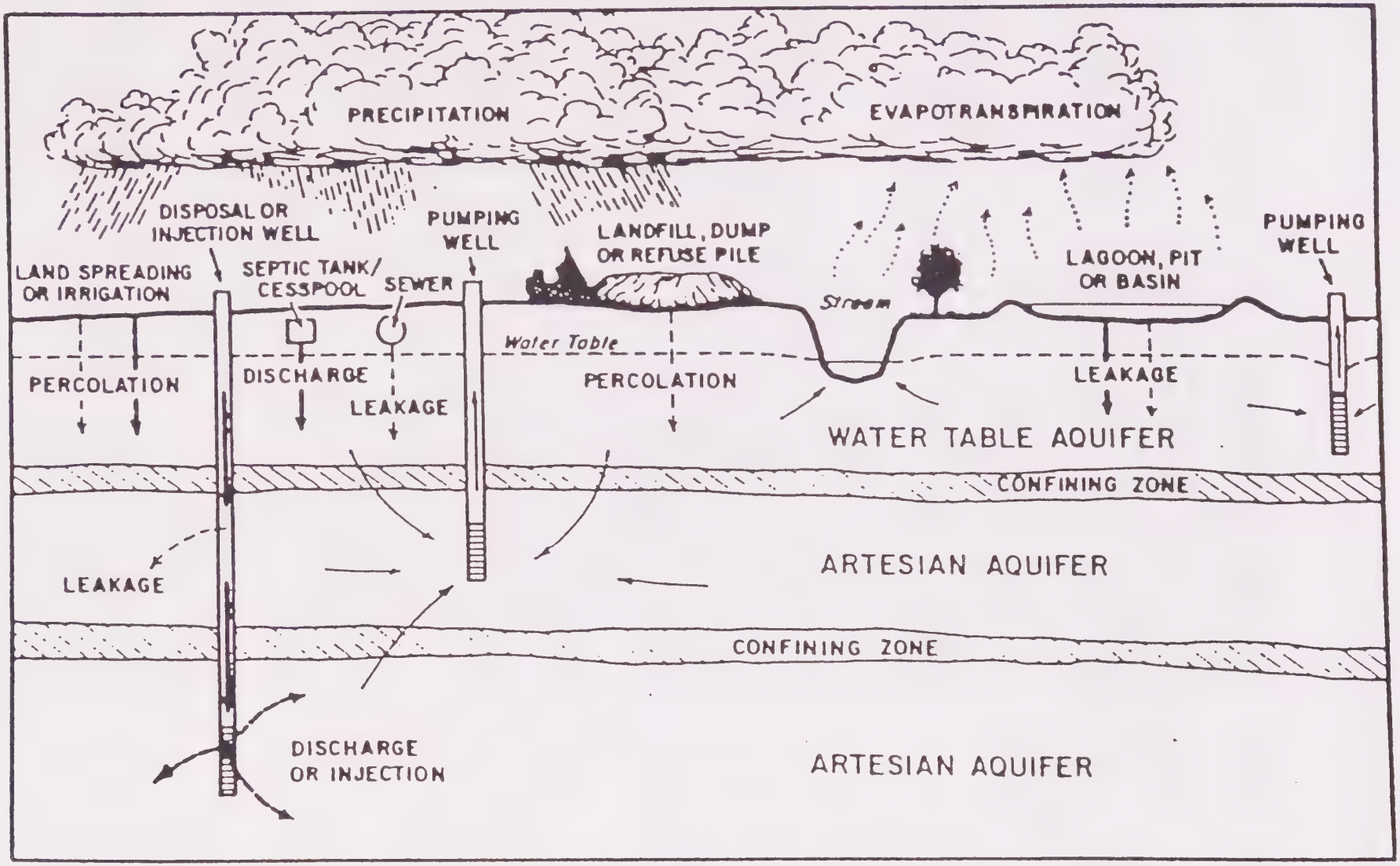
Leachate from solid waste disposal sites, hazardous waste sites, and surface impoundments can cause groundwater pollution. There are no hazardous waste disposal sites in the County at the present time, but the Department of Environmental Health Services (DEHS), in drafting a County Hazardous Waste Management Plan (unadopted at this time), has addressed the protection of surface and groundwaters in their siting criteria for future hazardous waste treatment and disposal facilities.

Land disposal of waste is regulated by several federal, state and local agencies. An adopted Solid Waste Management Plan has been prepared by the County identifying current sites. Overall, State Water Resources Control Board Regulations, also known as Subchapter 15 (of the California Administrative Code) implement provisions in the Porter-Cologne Water Quality Control Act. The provisions apply to all waste disposal to land, including surface impoundments and both hazardous and nonhazardous materials. Subchapter 15 regulations prescribe construction standards, monitoring requirements, and closure and post-closure procedures and requirements for waste disposal sites.

The classification of wastes, in addition to the construction standards of Subchapter 15, has had a definite impact on County landfills and surrounding areas. Unable to meet the new construction requirements for surface impoundments, some landfills have closed and others are threatened

Fig.4

Mechanisms of Groundwater Pollution



with closure. The County is also in the process of developing a sludge management plan which will comprehensively address the problem of sludge and septage disposal for the County.

Due to the fact that leachate has been detected at solid waste disposal sites throughout the State, the California Legislature required a one-time assessment of all the active and inactive sites for migration of hazardous wastes into surface or groundwater. The Solid Waste Assessment Test (SWAT) Program testing is currently being conducted for selected sites in the County. Test results, as reviewed by each regional board, may or may not require additional water analysis, drilling of monitoring wells, or other assessment measures. Several landfills operated by the County are known to be leaching various toxics.

b. Underground Storage Tanks

The threat to groundwater quality posed by leaking underground toxic storage tanks first came to public attention in 1981. It was discovered that numerous underground tanks were leaking hazardous substances into Santa Clara County's groundwater. In 1983 and 1984, the California Legislature enacted underground tank inventory and permit legislation. The Water Resources Control Board was required to complete the inventory of underground containers and provide this information to the appropriate regional boards, cities, and counties. The County has established and operates a permit program regulating all underground storage tanks of hazardous materials.

c. Agricultural Practices

An ongoing problem throughout San Bernardino County is the contamination of groundwater with pesticides and animal wastes. A study sponsored by the State Water Resources Control Board documented the presence of about 50 different pesticides in groundwater due to nonpoint (agricultural) and point source discharges. A separate investigation of public water systems discovered pesticides above Department of Health Services action levels in seven percent of the wells tested. In addition to pesticides, salt and nitrate buildup from irrigation water, fertilizers, and confined-animal waste degrade groundwater through leaching and percolation.

To prevent contamination from agricultural sources, the Regional Water Quality Control Boards attempt to regulate the discharge of pesticides and other materials to surface and groundwaters. Restricting animal uses per acre, manure stockpiling and wastewater ponding by the County's dairymen are examples of complying with Regional Board regulations to prevent groundwater quality degradation.

d. Septic Systems

Poorly sited, constructed, and maintained septic systems can degrade groundwater by inadequate treatment of human and other household wastes. Even properly operating systems may still degrade groundwater with discharged nitrates, bacteria, and especially hazardous household wastes.

The criteria for, as well as the design, installation and management of septic systems is regulated by DEHS, Building & Safety, and the Regional Water Quality Control Boards. Minimum distances to ground and surface water are prescribed, and percolation and system design standard are adhered to. Prohibiting septic systems in designated areas of the County has been mandated by the Regional Board when it was determined a potential for water quality degradation was possible or imminent. These areas include Forest Falls, Yucaipa, and Big Bear.

Regional Water Quality Control Boards, as entrusted with water quality protection, have directed further discharge requirements and minimum criteria for subsurface sewage disposal systems based on studies that indicate septic tank effluent adds nitrates to the groundwater. The most recent action taken by the Lahontan Regional Board in regard to nitrates was the adoption in January, 1988, of a basin plan amendment in which on-site sewage disposal systems were restricted to a density of two equivalent dwelling units per acre, or a discharge of 500 gallons/acre/day. Simply stated and for residential purposes only, a minimum lot size of one-half acre is required for each new house. The Regional Board, United States Geological Survey, and DEHS are conducting a three-year study to determine how septic tank/seepage pit systems are adversely impacting groundwater quality in the Victor Valley area as an adjoint to the new policy. A model will be

developed to allow assessment of the impact, and the Regional Board will use the assessment as a basis for requiring sewering for new construction.

e. Wells

Wells, and test boreholes which are improperly constructed or destroyed, can act as direct conduits through which pollutants pass from the surface into groundwater. Wells can also interconnect confined aquifers, transferring contaminants in both upward and downward directions. Wells which are perforated in more than one aquifer also may act as conduits between aquifers. EHS is the County department regulating the construction, reconstruction, abandonment and destruction of all wells in San Bernardino County.

Proper design and construction of any well--domestic, agricultural, or industrial -- is essential to minimize threats to groundwater quality. This is particularly important for monitoring wells since they intercept contaminants. Underground toxic storage tanks require monitoring wells to be installed. There is a mechanism in the land development review process which requires any improperly destroyed or abandoned wells to be properly destroyed. What appears to be lacking and should be addressed in the follow-up report is a mechanism to ensure that abandoned agricultural wells be destroyed to County standards whenever the change in land use presents a potential threat to groundwater quality.

9. Water Rights Laws

An understanding of the physical hydrogeologic conditions is only a portion of the information needed for preparation of a groundwater management planning program. The legal issues surrounding water are complex and complicated. A brief overview of Water Rights Laws is provided herein.

In order to better understand the issues of water resources protection and conservation, one should be familiar with California water rights law and recent Supreme Court decisions. The right to secure and use surface water has dominated the water rights issue, as the rights to groundwater have not been administered by the state except in those instances where judicial decisions have required the implementation of resource management (through adjudication).

Surface water rights in California fall into two major categories: riparian and appropriative. Riparian rights go only with land adjacent to a watercourse or a body of water. Holders of riparian rights have the right to use the natural flow of a stream, but they cannot store water. Since most of the land in California (and the County) is not situated near a body of water, the concept of appropriative rights was developed to allow for water needs when sources were not naturally available. An appropriative water right allows water users to transport water to any place of use, and to store water.

Riparian rights come under the control of the courts only when there is a legal dispute among competing water users, or when an action has been filed against the users on the basis of waste or unreasonable use. Appropriators, on the other hand, secure a specified flow or quantity under their right. After 1914, the state assumed appropriations of water and established a permit system that is now under the jurisdiction of the State Water Resources Control Board (SWRCB) which, over the years, has imposed numerous conditions over permits. The key to the appropriative doctrine is the concept of priority: first in time, first in right. Riparian rights have equal priority and ordinarily are senior to all appropriative rights.

A 1983 California Supreme Court decision focusing on the Los Angeles Department of Water and Power's diversion of water from the streams that feed Mono Lake integrated the California water rights system with the age-old English Law doctrine of "Public Trust," through which a state is required to hold in trust for future generations the values associated with certain resources. The decision essentially charged the State Board with the obligation to act as guardian or "trustee" for the beneficial uses dependent upon the public's water resources, and expanded the concept of the public trust doctrine to include not only the traditional uses of navigation, commerce, and fishing but also "changing public needs of ecological preservation, open space maintenance and scenic and wildlife preservation." Additionally, the court held that the public trust doctrine applies to diversions from streams tributary to navigable waters when such diversions may harm public trust uses of the downstream navigable waters. The court, in this landmark decision, held that the water law of California is an integration of this broadly defined public trust doctrine and the board-administered appropriative rights system. As such, reconsideration and possible curtailment of longstanding

water rights is authorized if necessary to protect the public trust, and all water rights affecting public trust resources must be viewed in light of "changing circumstances."

In its presently developed form, the public trust doctrine requires the courts and the State Board to perform a balancing test to weigh the value to society of a proposed or existing water diversion against protection of the public trust uses of the water.

In 1986, an historic decision of the state Court of Appeal (known as the Racanelli Decision) concluded that the State Board, in its water quality planning, improperly narrowed its scope to the impact and protection of water rights instead of all beneficial uses of Delta waters.

This ruling, allowed to stand by the California Supreme Court, instructs the State Board, when establishing flow and water quality standards for the Delta, to take into consideration all factors -not just the operation of the state and federal projects -which have a bearing on Delta water quality. The decision said the State Board had improperly based its previous salinity standards on levels which are needed to protect existing water rights, but that other "beneficial uses" must also be balanced in the public interest to protect all uses.

The ruling integrated the State Board's water rights and water quality authorities to protect water quality in the Delta, and potentially San Francisco Bay. This paves the way for more comprehensive water quality standards and possible restrictions on diversions of water under existing rights to provide adequate freshwater inflows to the Bay-Delta estuary.

The court also held that the State Board has the power to modify existing water rights permits and licenses; this could have a profound impact on the exercise of water rights by users above the Delta as the Board reviews, broadens, and refines water quality standards to provide reasonable levels of protection for beneficial uses.

These water rights laws and court decisions are relevant to San Bernardino County not only because of their (current) impact on the surface and groundwater, such as along the Mojave River and in areas of dwindling groundwater supply, but also because current imported water (State Water Project water) and future entitlements

(such as for MWA and other SWP contractors in the County) could be severely diminished or restricted.

10. Definition Summary

The issue of water supply and quality spans two of the mandatory General Plan elements. These are Conservation and Open Space. State law specifically requires that the reclamation of waters, prevention and control of pollution of waters, the regulation of land in streams and other sensitive areas, the prevention and control of erosion, and protection of watersheds be included in a General Plan.

This section of the Background Appendix represents the first time groundwater resource conservation countywide is being comprehensively investigated. Prior to this planning effort, the issues dealing with waters of San Bernardino County were handled on a case-by-case basis or by other agencies. Reliance upon other governmental agencies to develop policies and procedures for evaluating projects and their potential to degrade waters was all that was needed.

There are currently many purveyors of waters for beneficial uses within the County who have the mandate and authority to protect groundwater resources. Reliance on these agencies has been very high in the past. Projects were required to present "will serve" letters before they could even be considered for planning actions. This resulted in assumptions on the part of the County that if the "will serve" letter was issued, water supplies would be made available to future development. This was generally a part of the rationale for project approvals. This, however, has proven not to be the case as many system operators focused on system and not source enhancement.

Recently several communities experienced water outages. Most of these problems were associated with the delivery systems and not the physical availability of local groundwater supplies. Nonetheless it did point out quite clearly that more information was needed if continued development was to occur. The State Department of Health has also recently intervened and notified several of the purveyors within the County that serious violations have occurred in their water systems, including Hi Desert Water District in Yucca Valley, Southern California Water Company in Big Bear and Wrightwood. Major infrastructure improvements are required before additional development can occur in these areas.

Regional water quality control boards are also becoming involved more directly in the issue of water supply and quality by imposing limitations on subsurface disposal over the concern for long term water quality impacts. The most recent example of this policy applies in the Victor Valley area was previously discussed.

These events clearly indicate that more definitive actions are needed on the part of San Bernardino County's General Plan to augment the current regulatory framework. The advantages to this augmentation process are two-fold. First, by more clearly defining the limits and constraints in terms of water supplies we can protect existing as well as future development. Second, by examining land uses we can promote certain uses while simultaneously restricting uses which may prove harmful to the quantity and/or quality of the resource. Currently the General Plan identification of problems and problem areas is lacking, which results in project proposals that can not be approved.

This section the Background Appendix will attempt to bring into perspective the factors currently affecting local water supplies and the type of demands for water resources that can be expected in the future and present new goal and policy statements for consideration.

II. CURRENT STATUS

A. Sources of Data/Analysis

General information on water resources protection and conservation is quite extensive and readily available for the most part. The California State Department of Water Resources has numerous bulletins and reports containing data which are updated on a regular basis. Locally and regionally, information has been obtained from material (literature, reports, maps, charts, etc.) provided by California Department of Health Services, the Metropolitan Water District (MWD), the Soil Conservation Service, the Southern California Association of Governments (SCAG), Chino Basin Municipal Water District (CBMWD), Mojave Water Agency (MWA), Southern California Water Committee, and San Bernardino County Department of Environmental Health Services (DEHS).

B. Scope of Existing Conditions/Trends

San Bernardino County encounters the same problems and issues relevant to water resource protection and conservation as encountered by the state and other counties, particularly those in the southern section of the state. An attempt to

identify, describe, inventory, and address the factors, issues, and problems, both current and potential, which play a role in the protection and conservation of the water resources in San Bernardino County will be made. Many of the issues and topics relevant to the subject are identical or similar to those addressed in the Water Distribution System section of the Background Appendix. As partial overlap of the issues is inevitable, this section will strive to supplement rather than repeat the subjects and topics listed in the aforementioned.

1. Groundwater Quantity

Except for certain mountain areas of San Bernardino County, the major source of the County's potable water is from the existing sources of surface and groundwater, with, by far, the greatest quantity being supplied from the underground basins. There are no surface water sources in the desert region. Since most of the surface water supply is from runoff, most of the attention in this section will be given to groundwater, recharge, and pollution prevention.

San Bernardino County overlies three major groundwater provinces, and a minute portion of a fourth as determined by the State Water Resources Board. These are the South Lahontan, Colorado, upper Santa Ana and Los Angeles Water Control Board jurisdictional boundaries. These four regions are administered by their respective Regional Water Quality Control Boards, and their principal objective is to preserve and enhance the quality of waters, both ground and surface, for present and anticipated beneficial uses. Each of the four drainage provinces are distinctly different and are not connected hydrologically.

The Department of Water Resources has identified 357 groundwater basins in California. They were identified on the basis of geological and hydrological conditions with consideration of political boundary lines whenever practical. Seventy-four are all or partly located in San Bernardino County, with the breakdown as shown in Table 2: (The area covered by the Los Angeles basin is so small, less than 3 square miles, it is not included in the following summaries or discussions. See Figures 5 - 8.

TABLE 2

GROUNDWATER BASINS BY REGION

WQCB Region	Number of Groundwater Basins
Santa Ana	4
South Lahontan	42
Colorado	28
Total	74

The basins also have been broken down further into subunits and subareas based on drainage boundaries, subsurface characteristics, water bearing or non-water bearing formations, or local custom regarding use of a particular boundary. The Department of Water Resources has acquired data on individual basins related to the amounts of water in storage, yeild, quality concerns and potential for development. See Tables 3, 4 and 5.

Current and past studies by DWR indicate that certain groundwater basins are being overdrafted, due to agricultural activity in the past and current rapid population growth. While to date not identified as basins subject to critical conditions of overdraft, the major basins that have been identified as showing evidence of overdraft are contained in Table 6. This trend is expended to continue.

Local supply shortages has resulted in ajudication of 2 basins, and the recent enactment of water conservation ordinances by various water purveyors, and the County.

a. Conservation Ordinance Areas

Adjudication of the Warren Valley Groundwater Basin in the Yucca Valley/Joshua Tree area took place in 1977 as a result of overdrafting the basin. Studies indicated that the supply and demand for water were limited, and that supplemental water would be required to meet demands in future years. The most likely source of this supplemental water appears to be State Water Project water.

Hi-Desert Water District, watermaster of the Warren Valley Groundwater Basin, recognized the need for groundwater protection and conservation

HYDROLOGIC STUDY AREAS OF CALIFORNIA

Fig.5





Fig.6

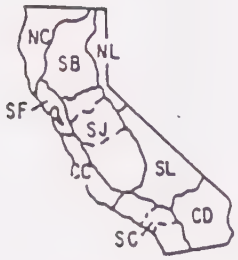
GROUND WATER BASINS - SOUTH LAHONTAN HYDROLOGIC STUDY AREA

Fig.7



GROUND WATER BASINS - COLORADO DESERT HYDROLOGIC STUDY AREA

Fig.8



STUDY AREA KEY



GROUND WATER BASINS - SOUTH COASTAL HYDROLOGIC STUDY AREA

TABLE 3

INVENTORY OF GROUND WATER RESOURCES
SOUTH LAHONTAN
HYDROLOGIC STUDY AREA—Continued

Basin number	Basin name, county	Basin description: size, major stream, water bearing material	Well yields in gpm		Depth zone in feet	Storage capacity in acre-feet	Usable capacity in acre-feet	Development	Degree of knowledge	Problems
			Max.	Aver.						
6-18	Death Valley, Inyo and San Bernardino Counties	A 1,280-square-mile basin with internal drainage. Major drainage channels are Salt Creek, Wingate Wash and Amargosa River. Younger and older alluvium.	Unknown	Unknown	20–220	11,000,000	Unknown	Limited for domestic and irrigation uses. A potential for moderate to high additional development. Major source of water from springs.	Limited for geology, hydrology and water quality in center and superficial at ends. References: DWR 118; USGS 56, 64, 101	Locally poor quality for domestic and irrigation use. High fluoride, boron, chloride, sulfate, TDS and percent sodium.
6-19	Wingate Valley, Inyo and San Bernardino Counties	A 70-square-mile basin drained by Wingate Wash. Younger and older alluvium.	Unknown	Unknown	100–300	870,000	Unknown	None. May have a potential for limited to moderate additional development.	Superficial for geology, hydrology, and water quality. References: DWR 118	None known.
6-20	Middle Amargosa Valley, Inyo and San Bernardino Counties	A 680-square-mile basin drained by the Amargosa River. Younger and older alluvium.	3,000	2,500	20–220	6,800,000	Unknown	Limited for domestic, irrigation, and industrial use. A potential for moderate to high additional development.	Limited for geology, hydrology, water quality. References: DWR 118, USBR 16, Misc. 19	Locally poor quality for domestic and irrigation use. High fluoride, boron, sulfate, and percent sodium.
6-21	Lower Kingston Valley, San Bernardino County	A 290-square-mile basin drained by unnamed streams. Younger and older alluvium.	Unknown	Unknown	100–300	3,390,000	Unknown	None. A potential for moderate to high additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 118	Locally poor quality for domestic and irrigation use.
6-22	Upper Kingston Valley, San Bernardino County	A 270-square-mile basin drained by Kingston Wash. Younger alluvium.	24	Unknown	50–250	2,130,000	Unknown	Limited for domestic and livestock use. A potential for moderate additional development.	Superficial for geology, hydrology, and water quality. References: DWR 118	Locally spring water is of poor quality for irrigation and domestic use. High fluoride, boron, chloride, TDS, sulfate, and percent sodium.
6-23	Riggs Valley, San Bernardino County	A 100-square-mile basin with internal drainage. Younger alluvium.	Unknown	Unknown	100–300	1,190,000	Unknown	None. A potential for limited additional development.	Superficial for geology, hydrology, and water quality. References: DWR 118	None known.
6-24	Red Pass Valley, San Bernardino County	A 150-square-mile basin drained by unnamed streams. Younger and older alluvium.	Unknown	Unknown	100–300	570,000	Unknown	None. A potential for limited additional development.	Superficial for geology, hydrology, and water quality. References: DWR 118	None known.
6-25	Bicycle Valley, San Bernardino County	A 180-square-mile basin with internal drainage. Younger alluvium.	700	Unknown	100–300	1,700,000	Unknown	Limited for military use. A potential for limited additional development.	Limited for geology and superficial for hydrology and water quality. References: DWR 118; USGS 61	None known.
6-26	Avawatz Valley, San Bernardino County	A 70-square-mile basin drained by unnamed streams. Younger alluvium.	Unknown	Unknown	100–300	580,000	Unknown	None. A limited potential for additional development.	Superficial for geology, hydrology, and water quality. References: DMG 3, USGS 118	None known.
6-27	Leach Valley, San Bernardino County	A 70-square-mile basin with internal drainage. Younger and older alluvium.	Unknown	Unknown	20–220	650,000	Unknown	None. A potential for limited additional development.	Superficial for geology, hydrology, and water quality. References: DWR 118, USGS 118	None known.

TABLE 3

INVENTORY OF GROUND WATER RESOURCES
SOUTH LAHONTAN
HYDROLOGIC STUDY AREA—Continued

Basin number	Basin name, county	Basin description: size, major stream, water bearing material	Well yields in gpm: Max.	Well yields in gpm: Aver.	Depth zone in feet	Storage capacity in acre-feet	Usable capacity in acre-feet	Development	Degree of knowledge	Problems
6-29	Manvelle Valley, Inyo and San Bernardino Counties.	A 180-square-mile basin with internal drainage. Younger alluvium.	1,500	1,090	90–290	580,000	Unknown	Limited for irrigation and domestic use. A potential for limited additional development.	Limited for geology, hydrology, and water quality. References: DWR 42, 112, USGS 187, Misc. 5.	Locally unsuitable for domestic and irrigation use.
6-30	Ivanpah Valley, San Bernardino County	A 330-square-mile basin with internal drainage. Extends into Nevada. Younger alluvium.	600	400	90–290	3,090,000	Unknown	Limited for industrial, irrigation, domestic, and stock use. A potential for moderate additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 94, 112, USGS 187	Poor quality.
6-31	Kelso Valley, San Bernardino County	A 370-square-mile basin drained by Kelso Wash. Younger and older alluvium.	370	890	200–400	3,340,000	Unknown	Limited for domestic, irrigation, and industrial use. A potential for moderate to high additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 112	Locally unsuitable for beneficial use.
6-32	Broadwell Valley, San Bernardino County	A 180-square-mile basin drained by unnamed streams. Younger alluvium.	Unknown	Unknown	100–300	1,880,000	Unknown	Limited for domestic and irrigation use. A potential for limited additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 37, 112	Locally poor quality for domestic use.
6-33	Soda Lake Valley, San Bernardino County	A 590-square-mile basin drained by the Mojave River. Younger alluvium.	8,100	1,100	90–290	9,300,000	Unknown	Limited for municipal, irrigation, industrial and domestic use. A potential for moderate to high additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 86, 112	Locally fluoride and TDS high for domestic use; percent sodium high for irrigation use.
6-34	Silver Lake Valley, San Bernardino County	A 40-square-mile basin with internal drainage. Younger alluvium.	Unknown	Unknown	50–250	380,000	Unknown	Limited for domestic use. A potential for limited additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 86, 112	Locally water quality unsuitable for domestic and irrigation use.
6-35	Cronise Valley, San Bernardino County	A 150-square-mile basin with internal drainage. Younger and older alluvium.	600	340	90–290	1,000,000	Unknown	None. A potential for limited to moderate additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 55, 112	Poor quality locally for domestic and irrigation use.
6-36	Langford Valley, San Bernardino County	A 50-square-mile basin drained by unnamed streams. Younger and older alluvium.	690	410	100–300	750,000	Unknown	Limited for military use. A potential for limited additional development.	Limited for geology, hydrology, and water quality. References: DWR 112, USGS 61	Locally fluoride and iron high for domestic use.
6-37	Coyote Lake Valley, San Bernardino County	A 150-square-mile basin with internal drainage. Younger and older alluvium.	1,740	660	1951 water level to base of fresh water-bearing unit	7,530,000	Unknown	Limited for irrigation and domestic use. A potential for moderate to high additional development.	Limited for geology, hydrology, and water quality. References: DWR 71, 83, 112, USGS 61	Locally fluoride and TDS high for domestic use. Quality poor for irrigation.
6-38	Coves Canyon Valley, San Bernardino County	A 100-square-mile basin drained by the Mojave River. Younger and older alluvium.	300	Unknown	1951 water level to base of fresh water-bearing unit	4,152,000	Unknown	Limited for domestic use. A potential for moderate additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 71, 83, 112	Locally quality poor for domestic use.
6-39	Troy Valley, San Bernardino County	A 130-square-mile basin with drainage tributary to the Mojave River. Younger alluvium.	1,700	300	90–290	2,170,000	Unknown	Limited for domestic, irrigation and industrial use. A potential for moderate additional development.	Limited for geology, hydrology, and water quality in west, superficial in east. References: DWR 71, 83, 112; USGS 47	Locally quality poor for domestic and irrigation use.
6-40	Lower Mojave River Valley, San Bernardino County	A 300-square-mile basin drained by the Mojave River. Younger and older alluvium.	1,700	550	90–290	5,100,000	Unknown	Moderate for municipal, and irrigation use. Limited for domestic and industrial use. Recharge under 1950–61 cultural conditions, 5,650 AF. A potential for moderate additional development.	Moderate for geology, hydrology, and water quality in west and limited in east. References: DWR 20, 71, 83, 112, USBR 13, USGS 47, 55, 112	Large area downstream of Barstow of poor quality for domestic use. Overdraft.
6-41	Middle Mojave River Valley, San Bernardino County	A 430-square-mile basin drained by the Mojave River. Younger and older alluvium.	1,500	500	1951 water level to base of water-bearing unit	8,048,000	3,000,000+ (Ground surface to 1951 water level)	Moderate for irrigation use. Limited for municipal, industrial, and domestic use. Recharge under 1960–61 cultural conditions 21,900 AF. 1960–61 extractions, 38,000 AF. A potential for moderate to high additional development.	Limited for geology, hydrology, and water quality. References: DWR 20, 71, 74, 76, 112, USBR 13, USGS 47	Locally quality poor for domestic and irrigation use. Overdraft.

TABLE 3

INVENTORY OF GROUND WATER RESOURCES
SOUTH LAHONTAN
HYDROLOGIC STUDY AREA—Continued

Basin number	Basin name, county	Basin description: size, major stream, water bearing material	Well yields in gpm		Depth zone in feet	Storage capacity in acre-feet	Usable capacity in acre-feet	Development	Degree of knowledge	Problems
			Max.	Aver.						
6-42	Upper Mojave River Valley, San Bernardino County	A 600-square-mile basin drained by the Mojave River. Younger and older alluvium.	3,600	630	1961 water level to base of water-bearing unit.	26,538,000	8,900,000+ (Ground surface to 1961 water level)	Moderate for irrigation, military, and municipal use. Limited for domestic and industrial use. Recharge under 1960–61 cultural conditions: 43,500 AF; extractions 57,000 AF. A potential for moderate additional development.	Limited for geology, hydrology, and water quality. References: D'&R 50, 71, 74, 118; USER 13; USGS 47	Locally quality poor for domestic use. Overdraft.
6-43	El Mirage Valley, San Bernardino County	A 190-square-mile basin drained by Sheep Creek. Younger and older alluvium.	1,000	230	20–220	1,760,000	Unknown	Limited for irrigation, industrial, and domestic use. A potential for moderate additional development.	Superficial for geology and limited for hydrology, and water quality. References: D'&R 118, USGS 6	Locally quality poor for domestic and irrigation use.
6-44	Antelope Valley, Kern, Los Angeles, and San Bernardino Counties	A 1,680-square-mile basin with primarily internal drainage. Major drainage channels are Littlerock and Big Rock Creeks. Younger and older alluvium.	2,550	770	Average ground surface elevation to base of fresh water	70,000,000	+Unknown	Intensive for irrigation and municipal use. Moderate for military and industrial use. Limited for domestic and recreation use. Safe yield about 58,000 AFY. 1970 extractions about 220,000 AF. A potential for moderate to high additional development.	Moderate for geology, hydrology, and water quality. References: D'&R 43, 79, 85, 118, S'&RCB 8, USGS 13, 31, 71	Locally quality poor for irrigation and domestic use. Overdraft. Failing septic tanks.
6-47	Harper Valley, Kern and San Bernardino Counties	A 310-square-mile basin with internal drainage. Younger alluvium.	3,000	785	1961 water level to base of fresh water	6,675,000	Unknown	Moderate for irrigation use and limited for industrial and domestic use. A potential for moderate to high additional development.	Superficial for geology. Limited for hydrology and water quality. References: D'&R 92, 118	Locally poor quality for irrigation and domestic use.
6-48	Goldstone Valley, San Bernardino County	A 30-square-mile basin with internal drainage. Younger alluvium.	Unknown	Unknown	100–300	810,000	Unknown	Limited for military use. A potential for moderate additional development.	Superficial for geology and hydrology. Limited for water quality. References: D'&R 92, 118	Locally poor quality for domestic and irrigation use.
6-49	Superior Valley, San Bernardino County	A 170-square-mile basin with internal drainage. Younger alluvium.	450	100	100–300	1,730,000	Unknown	Limited for domestic and stock use. A potential for moderate additional development.	Superficial for geology and hydrology. Limited for water quality. References: D'&R 92, 118	Locally poor quality for domestic and irrigation use.
6-50	Cuddeback Valley, San Bernardino County	A 130-square-mile basin with internal drainage. Younger alluvium.	550	300	100–300	1,380,000	Unknown	Limited for military use. A potential for moderate to high additional development.	Superficial for geology and hydrology. Limited for water quality. References: D'&R 92, 118	Locally poor quality for domestic and irrigation use.
6-51	Pilot Knob Valley, San Bernardino County	A 200-square-mile basin drained by unnamed streams. Younger and older alluvium.	550	300	100–300	2,460,000	Unknown	Limited for military use. A potential for moderate additional development.	Superficial for geology and hydrology. Limited for water quality. References: D'&R 92, 118	Locally poor quality for domestic use.
6-52	Searles Valley, Inyo, Kern, and San Bernardino Counties	A 850-square-mile basin with internal drainage. Younger and older alluvium.	1,000	300	20–220	2,140,000	Unknown	Moderate to high for industrial use (extraction of salts). Limited for domestic use. Water imported from Indian Wells Valley. A potential for limited additional development.	Moderate for geology and hydrology in center and superficial at ends. Limited for water quality. References: D'&R 90, 118; USER 15; USGS 48	Locally poor quality for domestic and irrigation use.
6-53	Salt Wells Valley, San Bernardino County	A 30-square-mile basin drained by unnamed streams. Younger alluvium.	Unknown	Unknown	20–220	320,000	Unknown	None. A potential for limited additional development.	Superficial for geology and hydrology. Limited for water quality. References: D'&R 90, 118	Locally poor quality for domestic and irrigation use.
6-54	Indian Wells Valley, Inyo, Kern, and San Bernardino Counties	A 280-square-mile basin with internal drainage. Younger and older alluvium.	2,800	815	20–220	5,120,000	Unknown	Moderate for municipal and irrigation use. Limited for domestic and industrial use. Natural recharge about 10,000 AFY. 1953 extractions about 23,500 AF. A potential for limited additional development.	Moderate for geology, hydrology and water quality in center and superficial at ends. References: D'&R 88, 112; USGS 14, 36, 65	Locally poor quality for domestic and irrigation use. High chloride, boron, and TDS.

TABLE 3

INVENTORY OF GROUND WATER RESOURCES SOUTH LAHONTAN HYDROLOGIC STUDY AREA

Basin number	Basin name, county	Basin description: size, major stream, water bearing material	Well yields in gpm		Depth zone in feet	Storage capacity in acre-feet	Usable capacity in acre-feet	Development	Degree of knowledge	Problems
			Max.	Aver.						
6-71	Low Lake Valley, San Bernardino County	A 30-square-mile basin with internal drainage. Younger and older alluvium.	Unknown	Unknown	Unknown	Unknown	Unknown	None. A potential for limited additional development.	Superficial for geology, hydrology, and water quality. References: DWR 118	None known.
6-76	Brown Mountain Valley, San Bernardino County	A 30-square-mile basin drained by unnamed streams. Younger and older alluvium.	Unknown	Unknown	Unknown	Unknown	Unknown	None. A potential for limited additional development.	Superficial for geology, hydrology, and water quality. References: DWR 118	None known.
6-77	Grass Valley, San Bernardino County	A 30-square-mile basin drained by unnamed streams. Younger alluvium.	Unknown	Unknown	Unknown	Unknown	Unknown	Limited for livestock use. A potential for limited additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 118	None known.
6-79	California Valley, Inyo and San Bernardino Counties	A 60-square-mile basin drained by unnamed streams. Younger and older alluvium.	Unknown	Unknown	Unknown	Unknown	Unknown	Limited for domestic, mining and livestock use. A potential for limited additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 118, DMG 2, 3	Locally fluoride marginal for domestic use.

Basins not covered in this DWR Report:

6-78 Denning Spring Valley
6-88 Owl Lake Valley
6-89 Kane Wash Area
6-90 Cady Fault Area

Summary

The South Lahontan Hydrologic Study Area (HSA), which is primarily desert, is drained internally with no outlet to the ocean. Three important rivers which flow throughout the year, at least in their upper reaches, are the Owens, Mojave, and Amargosa.

Total storage capacity for 50 of the basins, within selected depth intervals, is about 246.8 million acre-feet. Usable storage capacity of two basins is estimated to be about 11.2 million acre-feet. One major limiting factor affecting usable storage capacity is the occurrence of saline deposits within the sediments in many of the ground water basins.

Ground water temperatures generally range from about 50° to 86° F, but temperatures as high as 240°F have been recorded in Coso Hot Springs. Although the TDS content of the water varies considerably from basin to basin and within some basins, much of the water contains less than 600 mg/l. In Searles dry lake, a salt playa, TDS of the brine is in excess of 400,000 mg/l. The fresh water supply for the valley is obtained from springs flanking the valley and from imported water.

Valleys in which large volumes of ground water are used are Antelope, Indian Wells, Fremont and Upper, Middle and Lower Mojave River.

TABLE 4

INVENTORY OF GROUND WATER RESOURCES
COLORADO DESERT
HYDROLOGIC STUDY AREA

Basin number	Basin name, county	Basin description: size, major stream, water bearing material	Well yields in gpm		Depth zone in feet	Storage capacity in acre-feet	Usable capacity in acre-feet	Development	Degree of knowledge	Problems
			Max.	Aver.						
7-1	Lanfair Valley, San Bernardino County	A 280-square-mile basin drained by unnamed streams. Younger alluvium.	35	16	100-300	3,000,000	Unknown	Limited for livestock and domestic use. Natural recharge about 1600 AFY. Extractions negligible. A potential for limited to moderate additional development.	Superficial for geology and limited for hydrology and water quality. References: DWR 40, 42; USGS 117	Locally water high in sulfate and TDS, unsuitable for domestic use. Locally unsuitable for irrigation use.
7-2	Fenner Valley, San Bernardino County	A 790-square-mile basin drained by unnamed streams. Younger and older alluvium.	200	100	150-350	5,600,000	Unknown	Limited for livestock, domestic and industrial use. Natural recharge estimated at about 3000 AFY. 1952 extractions estimated at about 7.0 AF. A potential for limited to moderate additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 40, 42	None known.
7-3	Ward Valley, Riverside and San Bernardino Counties	A 770-square-mile basin. Drainage internal under low surface water flows. Younger alluvium.	260	180	100-300	8,700,000	Unknown	Limited for livestock and domestic use. Natural recharge estimated at about 2700 AFY. 1952 extractions estimated at about 2 AF. A potential for moderate additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 40, 87	Locally TDS, sulfate, fluoride, and chloride high for domestic use. Saline water near Danby dry lake. Locally unsuitable for irrigation use.
7-4	Rice Valley, Riverside and San Bernardino Counties	A 300-square-mile basin drained by unnamed streams. Younger alluvium.	65	Unknown	100-300	2,260,000	Unknown	Limited for domestic use. Natural recharge estimated at about 500 AFY. 1952 extractions estimated at about 1 AF. A potential for limited to moderate additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 40, 81	Locally chloride, TDS, fluoride, and sulfate high for domestic use; boron high for irrigation use.
7-6	Pinto Basin, Riverside and San Bernardino Counties	A 310-square-mile basin drained by unnamed streams. Younger alluvium.	1,480	900	0-100	230,000	130,000 400-foot pumplift, 100 feet of saturated sediments.	Limited for domestic and industrial use. 1952 extractions estimated at about 320 AF. A potential for limited to moderate additional development.	Limited for geology and hydrology in east and superficial in west. Limited for water quality. References: DWR 40; USBR 18; USGS 63	Locally fluoride high for domestic use percent sodium high for irrigation use.
7-7	Cadiz Valley, Riverside and San Bernardino Counties	A 430-square-mile basin. Drainage internal under low surface water flows. Younger alluvium.	167	66	20-220	4,300,000	Unknown	Limited for domestic use. Natural recharge estimated at about 800 AFY. 1952 extractions about 1 AF. A potential for moderate to high additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 40, 87	Poor quality in the vicinity of Cadiz dry lake.
7-8	Bristol Valley, San Bernardino County	A 710-square-mile basin with internal drainage. Younger and older alluvium.	500	125	20-220	7,000,000	Unknown	Limited for domestic and moderate for industrial use. Natural recharge estimated at about 2100 AFY. 1952 extractions about 11 AF. A potential for limited to moderate additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 40, 87	Poor quality northwest of Bristol dry lake. High fluorides along northeast boundary of valley.
7-9	Dale Valley, San Bernardino County	A 260-square-mile basin with internal drainage. Younger alluvium.	380	275	20-220	2,000,000	Unknown	Limited for domestic, irrigation, and industrial use. Natural recharge estimated at about 900 AFY. 1952 extractions about 1 AF. A potential for limited to moderate additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 40, 78; USBR 14	Poor quality in the vicinity of Dale dry lake

TABLE 4

INVENTORY OF GROUND WATER RESOURCES COLORADO DESERT HYDROLOGIC STUDY AREA—Continued

Basin number	Basin name, county	Basin description: size, major stream, water bearing material	Well yields in gpm		Depth zone in feet	Storage capacity in acre-feet	Usable capacity in acre-feet	Development	Degree of knowledge	Problems
			Max.	Aver.						
7-10	Twentynine Palms Valley, San Bernardino County	A 180-square-mile basin with internal drainage. Younger alluvium.	600	220	20–220	1,420,000	Unknown	Limited to moderate for domestic use. Natural recharge estimated at about 300 AFY. 1952 extractions 760 AF. A potential for limited to moderate additional development.	Superficial to limited for geology and hydrology and limited for water quality. References: DWR 40, 75; USBR 14; USGS 44, 110	Locally fluoride high for domestic use.
7-11	Copper Mountain Valley, San Bernardino County	A 110-square-mile basin with internal drainage. Younger alluvium.	525	300	20–220	830,000	Unknown	Moderate for domestic use. Natural recharge estimated at about 1100 AFY. 1969 extractions about 450 AF. A potential for moderate additional development.	Limited for geology, hydrology, and water quality. References: DWR 40, 75; USBR 14; USGS 72	Failing septic tanks.
7-12	Warren Valley, San Bernardino County	A 20-square-mile basin drained by unnamed streams. Younger alluvium.	550	290	20–220	180,000	Unknown	Limited for irrigation and domestic use. Natural recharge estimated at about 500 AFY. 1969 extractions about 1500 AF. A potential for limited additional development.	Limited for geology, hydrology, and water quality. References: DWR 40, 75; USBR 14; USGS 72	Failing septic tanks.
7-13	Deadman Valley, San Bernardino County	A 160-square-mile basin with internal drainage. Younger alluvium.	Unknown	Unknown	20–220	1,270,000	Unknown	Limited for domestic use. Natural recharge estimated at about 400 AFY. Water exported to Twentynine Palms Marine Corps Base. A potential for moderate additional development.	Limited for geology, hydrology and water quality in west and superficial in east. References: DWR 40, 75; USBR 14; USGS 72	Poor quality vicinity of Deadman dry lake
7-14	Levic Valley, San Bernardino County	A 40-square-mile basin with internal drainage. Younger alluvium.	140	80	20–220	870,000	Unknown	Limited for domestic use. Natural recharge estimated at about 300 AFY. A potential for moderate additional development.	Superficial for geology, hydrology, and water quality. References: DWR 40, 87	Locally TDS high for domestic use.
7-15	Bessemer Valley, San Bernardino County	A 85-square-mile basin with internal drainage. Younger alluvium.	Unknown	Unknown	20–300	740,000	Unknown	No development. Natural recharge estimated at about 300 AFY. A potential for limited to moderate additional development.	Superficial for geology, hydrology, and water quality. References: DWR 40; USBR 14, USGS 109	None known.
7-16	Ames Valley, San Bernardino County	A 150-square-mile basin with internal drainage. Younger alluvium.	Unknown	Unknown	20–220	1,200,000	Unknown	Limited for domestic use. Natural recharge estimated at about 700 AFY. A potential for moderate additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 40, 75; USBR 14; USGS 72	Locally unsuitable for domestic and irrigation use. High TDS, fluoride, and chloride
7-17	Means Valley, San Bernardino County	A 25-square-mile basin with internal drainage. Younger alluvium.	Unknown	Unknown	20–300	260,000	Unknown	Limited for livestock use. Natural recharge estimated at about 100 AFY. A potential for limited additional development.	Limited for geology and hydrology. Superficial for water quality. References: DWR 40, 75; USBR 14; USGS 72, 109	None known.
7-18	Johnson Valley, San Bernardino County	A 150-square-mile basin with internal drainage. Younger alluvium.	Unknown	Unknown	20–300	1,300,000	Unknown	Limited for livestock, irrigation, and domestic use. Natural recharge estimated at about 2300 AFY. 1952 extractions about 62 AF. A potential for limited to moderate additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 40; USBR 14; USGS 72, 109	Sulfate high for domestic use.
7-19	Lucerne Valley, San Bernardino County	A 260-square-mile basin with internal drainage. Younger alluvium.	2,500	700	1961 water levels to base of water-bearing unit.	4,736,000	2,500,000+ ground surface to 1961 water level.	Moderate for irrigation, domestic, and livestock use. Recharge under 1960–61 cultural conditions 5700 AFY. 1960–61 extractions 12,000 AF. A potential for limited to moderate additional development.	Limited for geology, hydrology, and water quality. References: DWR 40, 71; USGS 5, 109	Locally TDS, nitrate, chloride, sulfate, a fluoride high for domestic use; TDS a boron high for irrigation use. Overdraft.
7-20	Morongo Valley, San Bernardino County	A 14-square-mile basin drained by Big Morongo Creek. Younger alluvium.	600	90	20–220	100,000	Unknown	Moderate for domestic use. Natural recharge estimated at about 830 AFY. 1952 extractions about 230 AF. A potential for limited additional development.	Superficial for geology and hydrology. Limited for water quality. References: DWR 40; USBR 14; USGS 5, 109	None known.

TABLE 4

INVENTORY OF GROUND WATER RESOURCES
COLORADO DESERT
HYDROLOGIC STUDY AREA –.

Basin number	Basin name, county	Basin description: size, major stream, water bearing material	Well yields in gpm		Depth zone in feet	Storage capacity in acre-feet	Usable capacity in acre-feet	Development	Degree of knowledge	Problems
			Max.	Aver.						
7-41	Calzona Valley, Riverside and San Bernardino Counties	A 150-square-mile basin drained by Vidal Wash. Younger alluvium.	2,340	500	100-500	1,500,000	Unknown	Limited for domestic use. Natural recharge estimated at about 400 AFY. A potential for moderate additional development.	Limited for geology, hydrology, and water quality. References: DWR 40; USGS 79, 80	Locally sulfate, chloride, fluoride, and TDS high for domestic use; chloride high for irrigation use.
7-42	Vidal Valley, Riverside and San Bernardino Counties	A 160-square-mile basin drained by Vidal Wash a tributary to the Colorado River. Younger alluvium.	1,800	675	100-500	1,600,000	Unknown	Limited for domestic and irrigation use. Natural recharge estimated at about 350 AFY. A potential for moderate additional development.	Superficial for geology, and hydrology. Limited for water quality. References: DWR 40, 81	Locally fluoride, sulfate, chloride, and TDS high for domestic use; chloride and percent sodium high for irrigation use.
7-43	Chemehuevi Valley, San Bernardino County	A 440-square-mile basin drained by Chemehuevi Wash, a tributary to the Colorado River. Younger alluvium.	Unknown	Unknown	0-200	4,700,000	Unknown	Limited for domestic use. Natural recharge estimated at about 2300 AFY. A potential for moderate to high additional development.	Limited for geology, hydrology and water quality in east and superficial in west. References: DWR 40; USGS 81	Locally sulfate, chloride, fluoride, and TDS high for domestic use; percent sodium high for irrigation use.
7-44	Needles Valley, San Bernardino County	A 140-square-mile basin drained by Piute Wash, a tributary to the Colorado River. Younger alluvium.	1,500	980	0-200	1,100,000	Unknown	Moderate for irrigation and municipal use and limited for domestic use. Natural recharge estimated at about 1000 AFY. A potential for moderate additional development.	Limited for geology, hydrology and water quality. References: DWR 40; USGS 66, 67, 81	Locally sulfate, chloride, fluoride and TDS high for domestic use; chloride, TDS and percent sodium high for irrigation use. Overdraft.
7-45	Piute Valley, San Bernardino County	A 270-square-mile basin drained by Piute Wash. Younger alluvium.	360	200	300-500	2,400,000	Unknown	Limited for domestic use. Natural recharge estimated at about 1200 AFY. A potential for moderate additional development.	Limited for geology, hydrology, and water quality. References: DWR 40; Misc. 11	Locally sulfate and fluoride high for domestic use; percent sodium high for irrigation use.

Basins not covered in this DWR Report:

7-48 Helendale Fault Valley
7-49 Pipes Canyon Fault Valley
7-50 Iron Ridge Area
7-51 Lost Horse Valley

SUMMARY

In the Colorado Desert Hydrological Study Area, 61 groundwater basins and areas of potential ground water storage have been identified. The inventory covers 46 groundwater basins. These 46 basins, with a total area of about 12,500 square miles, have been identified as significant sources of ground water. The water-bearing deposits range in thickness up to 2,800 feet. In some basins flowing wells have been recorded.

Total storage capacity of 42 basins at selected depth intervals is about 162.8 million acre-feet. The estimated usable storage capacity in 7 basins is about 10.3 million acre-feet.

Groundwater temperatures range from about 60° to about 90°F. The TDS content of the water varies considerably from basin to basin. In most basins, it is less than 600 mg/l. In other basins, the dissolved solids content ranges into thousands of milligrams per liter. The highest recorded content is 304,000 mg/l.

The predominant character of the water is sodium sulfate or sodium chloride, but significant quantities of calcium and bicarbonate are also present at some places.

Groundwater extractions in the HSA are estimated at about 185,000 acre-feet.

TABLE 5

INVENTORY OF GROUND WATER RESOURCES SOUTH COASTAL HYDROLOGIC STUDY AREA

Basin number	Basin name, county	Basin description: size, major stream, water bearing material	Well yields in gpm		Depth zone in feet	Storage capacity in acre-feet	Usable capacity in acre-feet	Development	Degree of knowledge	Problems
			Max.	Aver.						
8-2	Upper Santa Ana Valley, Riverside and San Bernardino Counties	A 650-square-mile basin drained primarily by the Santa Ana River. Younger and older alluvium.	4,500	800	1950 water levels to base of fresh water	16,000,000	8,000,000+	Moderate to intensive for irrigation, municipal and industrial uses. Limited for domestic use. Safe yield about 230,000 AFY. 1970 ground water extractions about 450,000 AF. A potential for limited additional development.	High to intensive for geology, hydrology, and water quality. References: DWR 104, 105, 106, 174, 175; USGS 29, 30, 33, 34, 43, 86, 108, 128; Misc. 13	Locally, nitrate and TDS high for domestic use.
8-7	Big Meadows Valley, San Bernardino County	A 7-square-mile basin drained by the Santa Ana River. Younger alluvium.	Unknown	Unknown	10-60	10,000	3,500	Limited for domestic use. A potential for limited additional development.	Superficial for geology, hydrology, and water quality. References: DWR 18, DMG 7	None known.
8-8	Seven Oaks Valley, San Bernardino County	A 10-square-mile basin drained by the Santa Ana River. Younger alluvium.	Unknown	Unknown	10-60	14,000	4,700	Limited for domestic use. A potential for limited additional development.	Superficial for geology, hydrology, and water quality. References: DWR 18, DMG 7	None known.
8-9	Bear Valley, San Bernardino County	A 30-square-mile basin drained by Bear Creek. Younger alluvium.	1,000	500	10-60	42,000	14,000	Limited for domestic use. A potential for limited additional development.	Superficial for geology, hydrology, and water quality. References: DWR 18, DMG 7	None known.

Summary

The South Coastal Hydrologic Study Area (HSA) comprises the coastal drainage basins of California north of the Tia Juana River basin to the Ventura River drainage basin in western Ventura County.

Ground water temperatures generally vary from about 55° to about 90°F. TDS content of the water varies considerably from basin to basin.

In most basins the ground water is suitable for all beneficial uses. In basins where Colorado River water is being used for recharge, the ground water has begun to take on the qualities of the recharge water and is inferior to the natural water in the HSA. Hardness is another common water quality problem in many basins.

and adopted Ordinance No. 53 in September, 1987. The Ordinance established prohibitions and restrictions on the use of water in an effort to deal with waster shortage conditions caused by the continuing overdrafting of the basin. More recently, the District adopted a Policy Statement which "recognizes the critical overdraft of the District's primary source of water, the Warren Valley Basin, and that the only permanent solution to the overdraft condition is the importation of State Project water in sufficient quantity to satisfy current demands and additional demands resulting from a reasonable rate of growth." In recognition of the need to mitigate the overdraft demand, the Hi-Desert Water District requested the County impose special conditions on new land development projects requiring they contribute to a facility improvement plan for the construction of the facilities necessary to deliver supplemental water to the Warren Valley Basin.

TABLE 6
Groundwater Basins Showing Evidence of Overdraft
(DWR, 1980)

Region	Basin Name	Basin Number
South Lahontan	Lower Mojave River Valley	6-40
	Middle Mojave River Valley	6-41
	Upper Mojave River Valley	6-42
	Antelope Valley	6-44
	Harper Valley	6-47
	Indian Wells Valley	6-54
Colorado	Twentynine Palms Valley	7-10
	Warren Valley (ajudicated)	7-12
	Lucerne Valley	7-19
Santa Ana	Chino Basin (ajudicated)	8-2
	Bear Valley	8-9*

*Per information supplied by the Big Bear Community Services District.

The Board of Supervisors recognized that competing users of water could affect long term supplies in the Harvard/Newberry Springs area. Fearing continued overdafting of the lower Mojave River basin the first County Water Conservation ordinance was passed in 1986. The purpose is to establish water conservation measures and limit the

establishment of new irrigated crops, or landscaped areas greater than one acre, and lakes that could lead to increased overdrafting of water, mining or water resources, and disruption of water supplies. Land useage and water extraction are now being considered together by the County.

Indian Wells Valley Water District, located in the Lahontan Region, also has taken steps to address the overdraft condition of the groundwater basin. The District has drafted a proposed ordinance "recommending and/or requiring certain water conservation measures and establishing provisions applicable in the event of a drought or other threatened or existing water shortage emergency."

The City of Big Bear Lake is addressing the groundwater overdraft condition in the greater Big Bear Valley and within the area of the city served by their water purveyor, Southern California Water Company. On November 10, 1987, the city council adopted Ordinance #87-151 pertaining to the conservation of water. The stated purpose of the ordinance "...is to provide water conservation measures in order to minimize the effect(s) of a water shortage on the citizens of, visitors to, and the economic well-being of the city..." Goals, objectives, and policies used in implementing the ordinance are listed, as are prohibited uses of water, administration of the ordinance, and fines and penalties for any violations of the ordinance.

SCAG is projecting a substantial population increase in San Bernardino County by the year 2010. This illustrates that more water will be needed in the future as the demand increases with increasing population, and that the protection of the basins as a major water resource is of paramount importance and should not be left to chance. San Bernardino County will need to develop additional sources of water, with State Water Project water being one of the most likely sources.

b. Specific Groundwater Pollution Areas

Two examples of groundwater pollution or degradation can be found in the Mojave River Basin - the trichloroethylene (TCE) plume at George Air Force Base, and the "Barstow Slug." The plume at George AFB is located in groundwater below the northeast disposal area, and is compromised of large

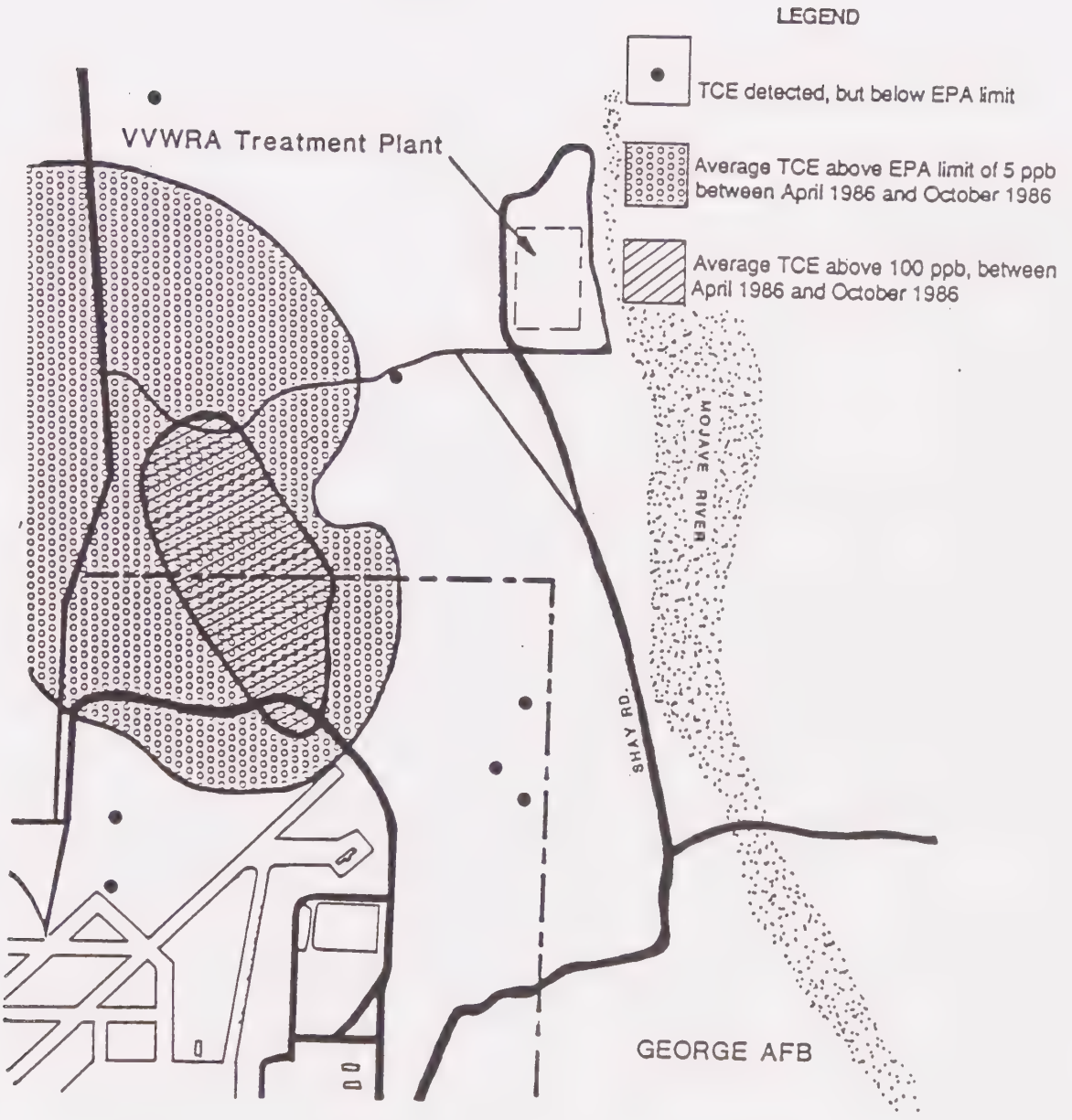
concentrations of TCE. Concentrated in the upper 20-30 feet of the perched zone, the TCE generally exceeds 20 parts per billion (ppb), and concentrations as high as 200 ppb have been measured (the State action level is 5 ppb). (See Figure 9)

The second groundwater contamination problem is in the Barstow area, and is commonly referred to as the "Barstow Slug" (See Figure 10). First detected in 1946, it consists of a number of drainage discharges into the Mojave River. The pollutants are mainly oil, fuel, and synthetic detergents. The "slug" is estimated to travel one mile every five years.

Groundwater quality in certain basins is something less than desirable, as in the case of the Twentynine Palms Valley Groundwater Basin. Here, groundwater has naturally occurring high fluoride concentrations that often exceed the maximum permissible level of 1.4 mg/l (maximum permissible fluoride concentrations range from 1.4 - 2.4 mg/l, based on the average maximum daily ambient temperature). High fluorides are a problem because continuous ingestion may cause mottling of tooth enamel of children up to 12 years of age. Continuous intake of higher concentrations could lead to more serious physical problems. An extensive study of the problem was conducted and completed by the DWR in 1984, and listed methods for reducing fluorides and increasing replenishment. Methods proposed included: Blending high with low fluoride concentration water; defluoridation at a central treatment facility; drilling new wells in low fluoride zones; importing water; recharging groundwater; and conserving water, especially through leak detection and repair. There are other areas in the County which also have high fluoride containing water, but none is as extensive or services such a large population as in the Twentynine Palms Water District.

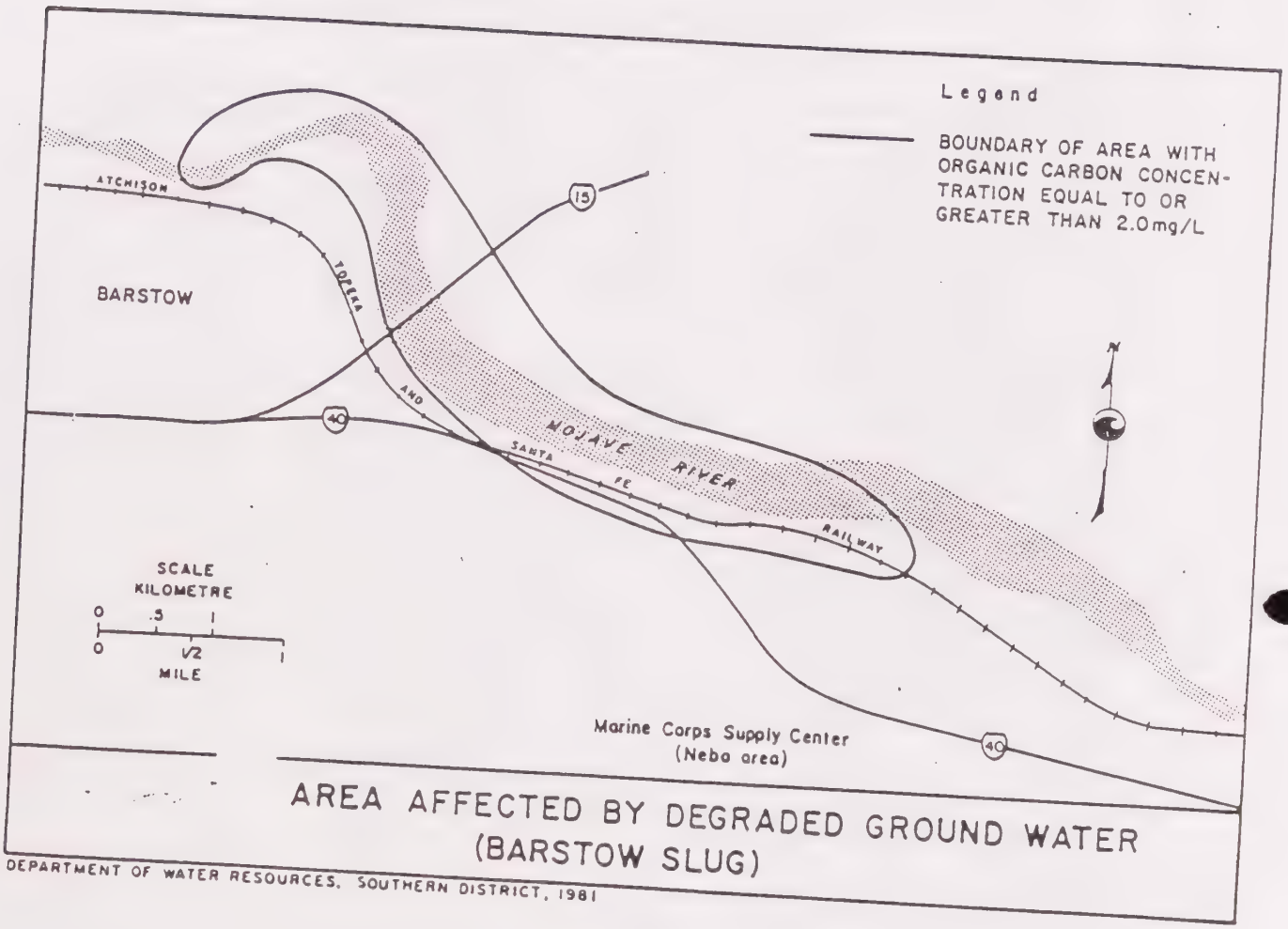
2. Ground Recharge and Land Use

At the present time, natural groundwater replenishment in the County does not come close to meeting total water demand. Therefore, enhancing recharge becomes an essential ingredient to a successful and well-thought resource management program. The purposes of artificial recharge are to:



APPROXIMATE LOCATION OF THE TRICHLOROETHENE PLUME BENEATH NORTHEAST DISPOSAL AREA

Fig.10


Legend
BOUNDARY OF AREA WITH ORGANIC CARBON CONCENTRATION EQUAL TO OR GREATER THAN 2.0mg/L
ATCHISON
TOPEKA
AND
SANTA
FE
RAILWAY
MOJAVE RIVER
BARSTOW
15
40
N
SCALE
KILOMETRE
0 .5 1
0 1/2 1
MILE
Marine Corps Supply Center
(Nebo area)
AREA AFFECTED BY DEGRADED GROUND WATER
(BARSTOW SLUG)
DEPARTMENT OF WATER RESOURCES, SOUTHERN DISTRICT, 1981

1. Reduce, stop, or reverse decline of groundwater levels;

2. Protect underground good quality water from inflow of poor quality water;

3. Store surface, reclaimed and imported water for future use; and

4. Deliver water to the point of use through soil-aquifer systems.

Artificial recharge is usually accomplished by means of storage and subsequent spreading basins or capture of runoff into pits, initiation areas, ditches, modified stream beds, and injection wells. The principal sources of groundwater recharge are storm flows, treated sewage effluent (wastewater), and imported water.

San Bernardino County Flood Control District was established in 1939. This was in direct response to devastating flooding which occurred in 1938. During that event lives were lost and much attention was given to protection of properties from flooding damage. Although named San Bernardino County Flood Control and Water Conservation District, flood control became its major concern. In fact, most of the streams in the valley portions which flooded during the 1938 episode have been transformed to concrete lined channels and underground pipes or conduits, lessening natural recharge. Large percolation basins associated with these systems are found along the San Gabriel and San Bernardino mountains.

Recharging of groundwater within the San Bernardino Valley began in 1911. The San Bernardino Valley Water Conservation District recharged native water on both the Santa Ana River and Mill Creek drainage by diverting water into spreading ponds at the upper end of the basin. Due to a court judgement and prior to 1970, total diversions on to the spreading ground of the Santa Ana River in any single water year were restricted to less than 9,000 acre feet. Since 1970, the conservation district has increased its spreading operation considerably. Between 1978 and 1983, it conserved and spread an average of 47,600 acre feet of water per year. Under contract with SBVMWD, the conservation district has also spread an additional 69,500 acre feet of imported SWP water.

The best locally available source for recharge of the Mojave River Valley Basin is in flood flows from major

storms originating in the San Bernardino Mount
Floodwater control, as mentioned earlier, ca
achieved through the use of dams and retention ba
The only flood control dam on the Mojave River i
Mojave River Forks Dam, located on the confluenc
the West Fork of the River and Deep Creek. Feasib
studies on gating the dam for conservation purp
have been completed, the most recent being in 1
The dam has a potential storage capacity of 89,700
feet of which 11,000 are allocated to sediment sto
as proposed. The dam could provide a significant so
of recharge water if the flood waters could be captu
retained, and transmitted to percolate into the depl
aquifers.

Imported sources are also available for recharge
desert aquifers. Completion of the Governor Edmund
Brown California Aqueduct and the Lake Silverwood
in the late 1960s provided for the first time import
water supplies to this portion of the County. The on
recharge projects undertaken to date have be
accomplished by the Mojave Water Agency. During thr
separate releases slightly more than 48,000 acre-fe
have been percolated into the Mojave River Basin
These releases occurred as follows: 1973-20,000 re
feet; 1978-12,000 acre-feet, and 1983-16,000 acre-et
With an understanding of hydraulic principles, th
Mojave Water Agency during the last two releases
awaited for storm surface waters to present themselves
prior to releasing waters. The net effect of this was
to be able to conduct waters through the upper and
middle basins for recharging of the lower basin, due to
the saturated nature of the river bed. This is a prime
example of why the hydrogeologists and planners need to
communicate. Through management principles such as
this the conveyance of waters within the desert regions
is enhanced. (See Figure 11).

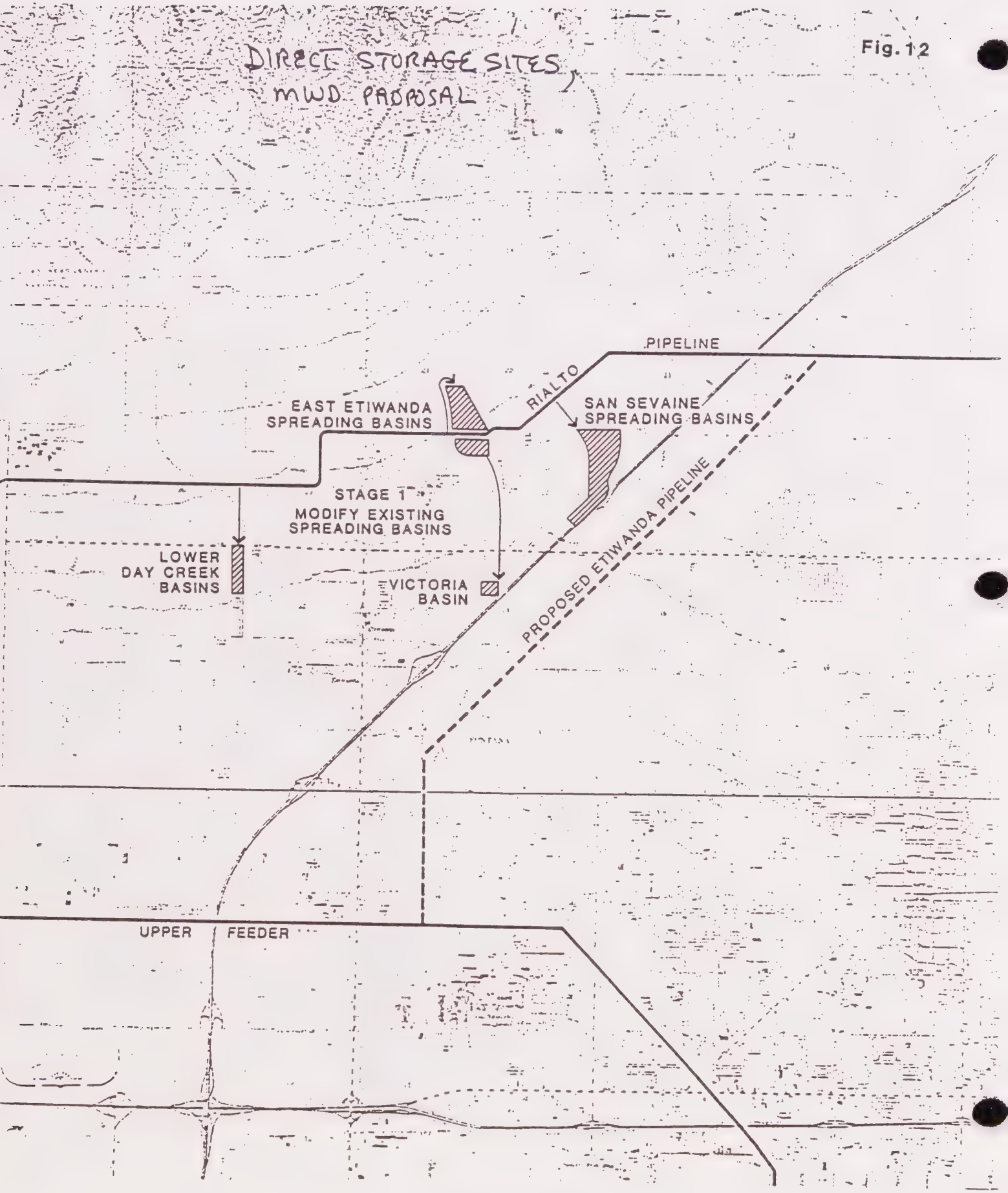
Currently, there are two major new proposals for
groundwater storage programs in the western part of the
County. The storage program as proposed by the
Metropolitan Water District of Southern California
(MWD) would store up to 700,000 acre-feet of imported
SWP water in the Chino Groundwater Basin. The water
would be used in emergency and drought conditions when
imported water is either limited or unavailable. Of
the three alternative projects in the proposed program,
one would involve direct recharge and the remaining two
projects would involve indirect recharge. Direct
recharge would be to only 7 of the 44 recharge facilities
in the legally defined Chino and Cucamonga Basins. (Se
Figure 12)

Fig.11

MOJAVE AND COLORADO RIVER SURFACE FEATURES

SCALE: 1 Inch = 14 Miles

Fig. 12


DIRECT STORAGE SITES,
MWD PROPOSAL
PIPELINE
RIALTO
EAST ETIWANDA
SPREADING BASINS
SAN SEVAINE
SPREADING BASINS
STAGE 1
MODIFY EXISTING
SPREADING BASINS
LOWER
DAY CREEK
BASINS
VICTORIA
BASIN
PROPOSED ETIWANDA PIPELINE
UPPER
FEEDER

The second proposal is the San Sevaine Creek Water Project by the U. S. Bureau of Reclamation. The project will consist of spreading grounds, basins, turnouts, and connecting channel systems, and will provide water conservation measures and help attenuate flooding conditions. Because the water percolation basins and runoff storage basins proposed in this project overlie the Chino Basin, the 25,000 acre-feet of conservable runoff in the form of groundwater percolation will aid in recharging the underground basin. (See Figure 12)

It should be quite apparent that the areas of groundwater recharge are crucial to the economic and social well-being of the entire County. With increasing urbanization and industrialization, there is increased runoff from streets and roof tops, and less open space for percolation and infiltration. The County is in a position to assume a leadership role in ensuring that existing recharge areas are protected, as well as encouraging the development of new ones.

3. Detection and Prevention Activies

The Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) of the Health and Safety Code prohibits discharge into drinking water sources chemicals known to be carcinogenic or reproductive toxins. One aspect of the program is State Water Control Board and Regional Board notification to counties of any hazardous waste discharge (notification to be within 72 hours of discharge). EHS has been designated the lead agency to coordinate public notification in the event of a toxic discharge into the County's drinking water supplies.

The State Department of Health Services (DHS), pursuant to AB 1803, sampled large water system wells (greater than 200 service connections), and discovered that many were polluted with toxic organic chemicals. In a similar sampling program of small water system wells (5-199 service connections), DHS also identified additional polluted wells.

As small water systems in the County, under the jurisdiction of EHS conducted the AB 1803 follow-up program of monitoring public water supply systems for organic chemical contamination. The study extended over a two-year period which began July 1, 1986, and was completed on February 29, 1988. All water systems included in the study were sampled for organic contaminants and, of the 262 wells sampled, 14 showed

some degree of contamination. Two exceeded the action level established by DHS. Contaminated wells were found in the Valley and Desert portions of the County. The water suppliers responded very quickly to the discovery of contaminants in their wells. In an attempt to minimize the health risk to their customers, suppliers closed wells, reconstructed contaminated wells, or sought interconnections to neighboring water systems. DEHS' complete report is on file at the County Environmental Health Services Offices.

4. Conservation

The arid and semi-arid climates of San Bernardino County have historically made the citizens aware of a continuing need for water conservation. It was not until the drought of 1976-77, however, that serious consideration was given to the need to establish and promote plans and programs to encourage more efficient use of water. DWR estimated that by 1985 and in urban areas alone, 180,000 acre feet of water per year had been conserved as a result of implementing water conservation programs.

Water conservation strategies in southern California (and the County) can be generally classified into two general categories: (1) System Management Measures; and (2) Measures to Prevent Unnecessary Water Use.

System Management Measures

Activity	Description
Distribution System Management	Includes water audits, leak detection, metering, meter maintenance and calibration, corrosion control, valve exercising, system pressure control, and other measures to reduce system losses.
Water Resource Management	Includes water reuse, groundwater replenishment, conjunctive use programs, exchanges and transfers, and water quality monitoring.
Emergency Contingency Plans	Includes various plans for emergency water conservation measures during events such as droughts or earthquakes.

Measures to prevent unnecessary water uses are basically designed to educate and assist the general public in maximizing the efficient use of existing water supplies, as well as reducing unnecessary water use. Activities of this second category are:

Measures to Prevent Unnecessary Use

Activity	Description
Public Information	Disseminating information on water conservation.
In-School Education	Formal education programs have been programs implemented at the elementary, high school, and college level.
Promotional Measures: Landscaping, Retrofit, Work With Large Water Users & Other Agencies	Landscaping, water fixture retrofitting, and cooperative effort programs to conserve water.
Pricing	Uniform, seasonal, wholesale, and other innovative rate structures to conserve water.

In 1983, the Urban Water Management Planning Act was passed by the Legislature, and required urban water retailers serving more than 3,000 customers (or providing more than 3,000 acre-feet per year) to adopt and prepare water management plans. The Act directs agencies to "identify conservation measures currently adopted and being practiced," to "describe alternative conservation measures, if any, which would improve the efficiency of water use," and "to provide a schedule of implementation for proposed actions as indicated by the plan." The Act further requires that "a plan projecting a future use which indicates a need for expanded or additional water supplies shall contain an evaluation of the following:

(a) Waste water reclamation.
(b) Exchanges or transfer of water on a short-term or long-term basis.
(c) Management of water system pressures and peak demands.
(d) Incentives to alter water use practices, including fixture and appliance retrofit programs.
(e) Public information and educational programs to promote wise use and eliminate waste.
(f) Changes in pricing, rate structures, and regulations."

Practically all, if not most, of the affected water agencies in the County have complied with the Act. Results of the Act have been compiled by the DWR, and are on the Department's computer file.

It is estimated that roughly half the water for residential use is used outdoors. Landscape water conservation can be a significant element of the overall conservation program. Large volumes of water are also used to irrigate parks, golf courses, athletic fields, highway strips and medians. Drought tolerant or low water use landscaping plants could be used to reduce the large volumes of water required. Other programs which need to be implemented because they are significant in water reduction are systems leak detection and water fixture retrofitting. Some agencies and cities have become innovative in the manner in which they implement these programs.

Agricultural interests have been developing and implementing ways to reduce on-site water use for years. Many different irrigation techniques have been developed to reduce and tailor water use for the varied irrigation conditions encountered.

In August of 1987, the Board of Supervisors approved the First District Water Policy. Although the policy was formulated for use in the First District, the policies, and especially those dealing with conservation and reclamation, are applicable to and could be incorporated by all areas of the County.

State Planning law (Section 65302(d)) requires the General Plan (water) conservation element be developed in coordination with water districts and agencies within the County. Written and verbal comments from these agencies relative to water conservation and water resources management were solicited. Numerous agencies responded and their comments and suggestions have been compiled.

OPEN SPACE/RECREATION/SCENIC

(Page Numbered Separately)

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ADDENDA

Addendum 1: Table D, Land Acquisition Cost Estimates

FIGURES

Implementation Matrix (Follows Addendum 1)

I. BACKGROUND INFORMATION

This section of the Open Space Background Report provides expanded information on some open issues which is not included in the Open Space Element, as well as a bibliography of information sources noted in the Element.

For detailed information on specific issues, such as biology or hazards, the General Plan Background Reports on those topics should be consulted.

A. MAJOR OPEN SPACE AREAS

Although a detailed inventory of existing open space areas in the County is not included in this Background Report, the following is a general description of the major areas which have been identified in the initial research already conducted. More detailed descriptions will be identified as the planning process continues.

In general terms, the County can be divided into three distinct areas: Desert, Mountain, and Valley. The following is a brief description of these areas, followed by a more focused examination of sub-areas within these broad regions.

1. Desert Areas

The vast majority of land within the County can generally be categorized as "desert." As regards these areas of the County, the sheer vastness of the desert, which is one of its most striking assets, may also serve to diminish the perceived importance of protecting its resources. It is likely that, in the view of many citizens, both in the desert and other portions of the County, there is "desert to spare," although this is not the case; in fact, the desert is under substantial pressure from development and man's uses.

Since they are physically separated from the urbanized portions of the County and are markedly different from other areas (both in physical features and in regulatory/political character), the Desert region has been provided with specific policies to address the issues present there.

2. Mountain Areas

The San Bernardino mountains serve as a significant resource of natural lands, an important scenic backdrop, and a physical barrier between the Desert and Valley regions. Like the desert, the mountain areas of the County are worthy of special consideration and policies to deal with issues unique to the area (as has already taken place in the adoption of a number of Community Plans dealing with various mountain areas).

The mountain areas in the County receive the majority of the snowfall which occurs in the County, adding to their importance as wildlife habitat (since similar climates are not available elsewhere), making them both an important portion of the local water supply system, and adding to their value as a regional recreation destination.

The mountain areas also contain a substantial inventory of special, threatened, and endangered species. The three-spined stickleback fish, discussed in the Open Space Element and the General Plan Biological Background Report, is only one example of a number of critically endangered species and habitats which exist in very limited numbers only in the mountain areas.

3. Valley Areas

Although decades of development have substantially altered the character of the Valley areas and removed many open space areas, this portion of the County is of considerable importance for several reasons.

The Valley areas of the County are very important to the success of the County's open space plan for the simple reason that the majority of voters who may ultimately be asked to fund open space acquisition and management reside in Valley communities. These voters were responsible for the recent adoption of an increased sales tax to fund transportation improvements (desert area voters did not support the measure by the required two-thirds majority), and must be accounted for in any effort to build support for an open space system.

The fact that the majority of County residents reside in Valley areas also adds to the importance of providing open space and recreation opportunities in this region. Open space lands of all types in this region will be more visible and accessible to a large number of persons than areas in the deserts or mountains.

And, while the majority of open areas in the Valley region

have been eliminated through the process of development, this dearth of natural areas adds to the importance of the remaining areas. One habitat still found in the Valley region, "Riversidian sage scrub," has attracted the attention of Nature Conservancy, which recently visited several remaining areas with this habitat type to determine whether purchase of lands by that group should be pursued.

The placement of the Valley between several large expanses of open space--the mountains to the north and the Chino Hills and Cleveland National Forest to the south and west--also makes this area important in terms of providing linkages between these areas (for recreation patrons and wildlife).

The following major sub-regions have also been identified:

4. Chino Hills

The Chino Hills serve a number of open space purposes. The Chino Hills State Park is a major recreational resource, and provides protection for a number of sensitive biological resources. This sub-region is also located near several other important open space areas which combine to make the southernmost portion of the County a major open space resource.

The Open Space Map of the Resources Overlay indicates a wildlife corridor zone connecting the Chino Hills State Park with other major open space areas.

5. Prado Basin

Although located primarily outside the County, the Prado Basin is a significant reservoir of riparian habitat, and provides habitat for a number of species, including the endangered Least bell's vireo, which requires specific types of willow habitat found within Prado Basin. The open space plan should recognize the importance of this open space resource, and its value to both wildlife and the public.

6. Chino Agricultural Preserve

As noted elsewhere in this Background Report, the Chino Agricultural Preserve is of great importance to the County, which benefits from the significant dairy industry located here. The Agricultural Preserve represents the largest, most active agricultural region in the County, a status which has already been reflected in the actions of the Board of Supervisors to retain agricultural uses at least through 1997.

The Open Space Map of the Resources Overlay indicates the general location of the Chino Agricultural Preserve.

7. Crafton Hills

As an "island" of open space in the midst of several rapidly expanding communities, the Crafton Hills are important both as a potential recreational destination and as a reservoir of habitat for wildlife. Support for the creation of an open space area in the Crafton Hills has already been expressed by the Cities of Yucaipa and Redlands and the County, adding to the potential that this area can be included in the Countywide open space system.

The Open Space Map of the Resources Overlay indicates two policy area in the general location of the Crafton Hills--one area is intended for specific application of agricultural preservation actions, the other indicates an area which is desired to remain in open space uses.

8. Santa Ana River

The Santa Ana River, which provides a major physical link between the mountains and the Prado Basin (and ultimately to the Pacific Ocean), should be a major element in the open space plan. Planning is already under way to establish a multi-use trail along the Santa Ana River from its headwaters in the San Bernardino Mountains to the Pacific Ocean; the open space plan should also recognize the importance of the River as a wildlife dispersion corridor through the urbanized areas of the Valley region.

The Open Space Map of the Resources Overlay contains a wildlife corridor along the length of the Santa Ana River to preserve (or in some areas improve on) its function as a dispersion corridor.

9. Mojave River

As one of the few perennial watercourses in the Desert region, the Mojave River is critically important to many wildlife species. Although a nature preserve has already been established along a portion of the river, expansion of the protected portion of the Mojave River should be considered as part of the open space planning process.

The Open Space Map of the Resources Overlay indicates that a wildlife corridor should be provided along the length of the Mojave River to preserve its function as an area for wildlife.

10. Big Bear Area

The area in and around Big Bear Lake contains a number of important open space resources, including several examples of important habitat found only in this area. The U.S. Forest Service, which has jurisdiction over much of the land around Big Bear Lake, is very interested in the potential to expand the protection the County can provide for these natural areas, which in many cases occur on private lands.

The Open Space Map of the Resources Overlay designates the watershed of Big Bear Lake for specific application of natural resource preservation policies.

11. BLM Areas of Critical Environmental Concern

The following are areas of concern identified by the Bureau of Land Management (BLM). For mapping of these areas, refer to the BLM's California Desert Conservation Area Plan.

TABLE A
BLM AREAS OF CRITICAL ENVIRONMENTAL CONCERN

Name	Acreage	Special Values
Trona Pinnacles	6,360	One of the most outstanding examples of tufa (calcium carbonate) deposits in the nation, the area is highly scenic.
Grimshaw Lake	960	An unusual aquatic habitat, the area is home to several sensitive fish species and more than 200 species of birds.
Amargosa River	9,299	Contains aquatic habitat and vegetation, hosting the sensitive Amargosa River pupfish, Amargosa vole, speckled dace, and providing shelter to more than 200 species of birds.
Salt Creek (Dumont)	2,109	Provides critical habitat for the California blackrail, desert pupfish, and the Yuma clapper rail.

TABLE A (Cont'd)
BLM AREAS OF CRITICAL ENVIRONMENTAL CONCERN

Name	Acreage	Special Values
Clark Mountain	17,826	A scenic national landmark, rich in flora and fauna, including the largest stand of white fir in the California Desert. It contains many historic and prehistoric sites.
New York Mountains	54,750	Extensively used by universities for research, this scenic area has diverse groupings of vegetation as well as bighorn sheep.
Ft. Piute	4,175 Ft.	Contains Piute Spring and Piute Creek, one of the desert's few perennial watercourses, making the area rich in natural and cultural values.
Fort Soda	6,770	Fort Soda, on the ancient shoreline of Lake Mojave, has several salt marshes supporting the Mojave chub and Saratoga Spring pupfish. The area, containing the Old Government Road and a portion of the old Tonopah and Tidewater Railroad, has other cultural artifacts indicating human habitation for at least 9,000 years.
Afton Canyon	4,904	Highly scenic, the canyon is one of the two places the Mojave River surfaces and sustains extensive riparian habitat for raptors and bighorn sheep.
Eriophyllum	320	This site provides protection for the Eriophyllum mohavense (Mojave woolly sunflower), under consideration for listing as a threatened species.

TABLE A (Cont'd)
BLM AREAS OF CRITICAL ENVIRONMENTAL CONCERN

Name	Acreage	Special Values
Harper Dry Lake	480	The area contains a quality marsh habitat for birds, including two endangered species--the Yuma clapper rail and bald eagle.
Mojave Fishhook	640	The extremely rare yellow-spined form of the cactus Sclerocactus is found in this area.
Upper Johnson	310	The valley has unusual groupings of the ancient Mojave yucca.
Soggy Dry Lake	278	The site includes unusual plant groupings of creosote bush rings, which may be the world's oldest living plant.
Big Morongo Canyon	3,186	The canyon is a desert oasis with perennial water flowing over three miles, supporting extensive riparian vegetation. At least 235 species of birds have been observed.

12. SCAG Open Space Areas of Regional Significance

As part of its 1975 regional plan of open space areas, the Southern California Association of Governments identified a number of areas within San Bernardino County as critical open space areas.

These areas, which are listed below, are mapped in SCAG's 1975 plan, although the level of detail is in many cases not specific enough to provide useful planning information. Many of these areas have also been identified by the Bureau of Land Management and the U.S. Forest Service.

TABLE B
SCAG AREAS OF REGIONAL SIGNIFICANCE

Area	Significant Resources
Amargosa	Seasonal stream with desert riparian habitat. Some permanent pools. Special wildlife include Tecopa pupfish and relict crayfish. Dumont dune adjacent to river provide specialized dune habitat.
Amboy Crater	Volcanic crater and associated formations. Habitat for Microrionata rowelli amboriana, a relatively rare gastropod.
Big Bear Lake and Surrounding Area	Large artificial lake, surrounded by ponderosa forest. Very heavy recreational use.
Bighorn-Whitewater Area	Large area of approximately 254,000 acres, mostly in public ownership. Mixed joshua tree, pinon pine, and juniper woodland.
Cable Canyon Creek	Vegetated canyon in low foothills. Riparian chaparral habitat.
Cadiz Dunes	Area of natural dunes used by off-highway vehicles.
Cajon Creek	Permanent stream in dry brushy mountain pass. Chaparral and some riparian vegetation.

TABLE B (Cont'd)
SCAG AREAS OF REGIONAL SIGNIFICANCE

Area	Significant Resources
Calico Recreation Lands	208,000 acres, approximately 1/3 private. Prime areas include: Black and Opal mountains (including petroglyphs), Rainbow Basin (fossil area, National Natural Landmark), Calico Ghost Town Regional Park, Joshua View (rich Joshua tree woodland), and Calico Early Man site. Entire area heavily used and vandalized.
Chemehuevi Mtns.	Good example of desert mountain wilderness. Geologic and biologic values above average.
Chino Hills	Grassland and oak woodland habitat.
City Creek	Permanent stream in dry area. Riparian area.
Clark Mountain	23,000 acres of BLM land closed to OHV use.
Colorado River	Nevada state line to Lake Havasu. Extraordinary "combination" stream of cold and warmwater fish and riparian habitat. Wildlife along entire portion of river in San Bernardino County includes: Yuma clapper rail, Bighorn sheep, Humpback sucker, Bonytail fish, Colorado squaw fish. Topock Gorge is a special area of significance in this stretch of river--good example of Tertiary volcanics, as is Redrock Gorge.
Coxcomb Mtns.	Relatively undisturbed desert ecological area, supporting desert tortoise and Bighorn sheep.
Cucamonga Canyon Mylonites	Geologic area, large mylonite crystals. Chaparral and Bigcone douglas fir.

TABLE B (Cont'd)
SCAG AREAS OF REGIONAL SIGNIFICANCE

Area	Significant Resources
Death Valley National Monument	Portion in San Bernardino County. National Extraordinary wildlife and geologic values.
Eastern Mojave Recreational Lands	Total of approx. 825,000 acres, mostly public ownership.
Fort Piute and Piute Springs, Piute Creek and Piute Range	6,000 acre area, containing historic ruins of fort built to protect wagon trains from Indian attack. Running spring provides significant habitat supporting the Mojave chub Gila bicolor Mojavensis in Piute Creek.
Fort Soda (Zzyzk Springs)	Contains the only naturally occurring population of Mojave chub.
Grapevine Canyon	28,000 acres on northern flank of San Bernardino Mountains, habitat ranging from pinon forest to high desert types.
Indian reservations	Located along Colorado River.
Joshua Tree National Monument	Portion located in San Bernardino County.
Jurupa Hills	Isolated hills north of Santa Ana River. Riparian and sagebrush habitat.
Kingston Mtns.	12,000 acre area with archaeological and natural values. Habitat for desert tortoise and Bighorn sheep.

TABLE B (Cont'd)
SCAG AREAS OF REGIONAL SIGNIFICANCE

Area	Significant Resources
Lake Arrowhead and Surrounding Area	Artificial lakes in pine forest. Wildlife species being displaced. Area drains into Lahontan groundwater basin, posing water quality problems.
Lanfair Valley	Large high desert valley--approx. half in public ownership. Joshua tree woodland in good condition.
Lower Lone Pine Canyon	Riparian, sage, and chaparral habitat.
Lytle Creek	Permanent stream, riparian vegetation.
Mill Creek Canyon	Private and public lands important for recreation.
Mount San Antonio	10,064-foot peak in San Gabriel Mountains. Alpine vegetation, Bighorn sheep, limber pines.
Military lands	Very large holdings.
Mojave River	Annual stream from Lake Arrowhead to Soda Dry Lake runs mostly underground, surfaces at Mojave Narrows and Afton Canyon. Desert riparian waterway.
Old Woman Mtns.	116,000 acres. Considerable mining and prospecting in areas. Bighorn sheep, mountain lions, juniper woodlands. Some recreation use.
Oro Grande Wash	Original cement mine in California; kiln still exists. OHV use.
Owlshead	Scenic mountain valley and lake area with little evidence of use by man.

TABLE B (Cont'd)
SCAG AREAS OF REGIONAL SIGNIFICANCE

Area	Significant Resources
Pisgah Crater	Volcanic formation, biotic communities on recent basaltic formations. Located in Twentynine Palms Marine Base.
Pinnacles Geologic Area	Peculiar rock formation, possibly volcanic. Chaparral, some Coulter pine.
Quaking Aspen Stand	Isolated stand of quaking aspen, southernmost in U.S., partially protected by San Gorgonio Wilderness.
Rodman Mtns.	454,000 acres. Excellent archaeological values in eastern portion. Heavy recreation and OHV use. Prime habitat values.
San Bernardino Mountains (All)	Rugged to rolling mountain area. Habitat for Bighorn sheep, puma, and bear.
Santa Ana River Headwaters	Many dendritic streams. Riparian vegetation.
Santa Ana River	Vegetated wash in foothills. Riparian vegetation in lower reaches cleared for flood control. Permanent water flow.
San Gorgonio Wilderness	Rugged mountain area. Contains Mt. San Gorgonio (11,502 ft.), highest point in Southern California. Mixed conifer and alpine vegetation. Bighorn sheep habitat.
San Timoteo Wash	Vegetated wash in foothills, riparian habitat.
Silverwood Lake	Large reservoir, wintering habitat for Bald eagle.

TABLE B (Cont'd)
SCAG AREAS OF REGIONAL SIGNIFICANCE

Area	Significant Resources
Primitive Areas	Lava and Argus mountains. Geothermal and wildlife values.
Sacramento Mtns.	Rugged desert mountain wilderness.
Sheephole Mtns.	Mining and recreation land. OHV area adjacent to Joshua Tree National Monument.
Trona (tufa) Pinnacles	11,000+ acres. Best example of tufa formations in North America. Supports Mojave ground squirrel and desert tortoise. Geothermal values.
Turtle Mtns. and Mopah Peaks	97,000 acres. Highly scenic, outstanding geologic values, exceptional biological and ecological values.
Whipple Mtns.	110,000 acres, 95,000 public. Outstanding geologic and natural values. Supports Bighorn sheep and burro deer.

B. AGRICULTURE

Agricultural lands currently comprise an important part of the existing open space system in San Bernardino County. Located in many cases adjacent to or within urbanizing areas, agricultural lands provide not only economically valuable crops, but also serve as resources of "open land," defining the edges of cities and providing aesthetic values. This section of the Open Space Background Report examines a number of issues related to agriculture, and discusses how agricultural lands can fit into a Countywide open space strategy.

1. Agriculture in San Bernardino County

Farming is one of San Bernardino County's most important industries. According to the most recent report on the County's agricultural production (1989), the total value of agricultural products produced in the County exceeded $630-million.

A wide variety of crops are currently produced in the County, ranging from small amounts of specialty crops to millions of dollars of dairy products. In terms of dollar value, milk production--concentrated in the Chino Agricultural Preserve--remains the largest component of the farm economy. Milk production in 1989 accounted for more than 63 percent of the County's agricultural output, producing products valued at more than $400-million. Despite attempts by the federal government to reduce milk production (encouraging farmers to accept cash subsidies in return for agreeing not to operate), the number of producing milk cows in the County increased in 1989 to a total of 183,000. This historically high number of cows (only slightly higher than in recent years) continues to make the Chino Agricultural Preserve the highest concentration of cows in the United States.

Agriculture in San Bernardino County, despite the robust health indicated by the value of crops it produces, is approaching a crossroads. The booming construction of homes and businesses, which owes its distant roots in part to land speculation sparked by citrus industry, in many areas threatens to overrun the County's remaining farmland.

Indeed, a review of aerial photographs taken in the mid-1970s with maps of existing (1989) farmland dramatically illustrates the fast pace at which conversion of farmland to urban uses has taken place. In many foothill communities, such as Upland, citrus districts operating in the 1970s have been

completely replace by residential subdivisions. The same pattern is echoed elsewhere, particularly in cities closer to Los Angeles and Orange counties.

The Chino Agricultural Preserve, by comparison, has remained virtually intact over this same period (and, as noted above, has actually seen an increase in activity). This is in part due to the imposition of land use controls by the County of San Bernardino which limit uses in the Preserve to those which are related to agriculture. Still, the Preserve's long term future remains somewhat uncertain, despite heroic efforts to maintain the dairy industry.

In a recent decision, the Local Agency Formation Commission (LAFCO), a regional agency which arbitrates the decisions of cities to expand their limits (and the areas to which they will provide city services) requested that the cities of Chino and Ontario reach an agreement on the extension of their influence areas into the Preserve. And a major residential development project, Archibald Ranch, at the northernmost edge of the Preserve, has been variously decried and heralded as the first step in the conversion of the Preserve to urban uses. Despite the County's stated intention to retain agricultural uses in the Preserve until at least 1997, differences in opinion exist between farmers wishing to remain and those who would take profits from the sale of their land (at higher urban values) and re-establish dairies elsewhere.

As part of Proposition 70 bond issue approved by voters in 1988, a total of $20-million was made available to purchase land in the Preserve with the ultimate aim of maintaining agricultural uses. The Southern California Agricultural Land Foundation has been contracted by the County to administer the acquisition of lands, but to date no properties have been purchased. Ontario Mayor James Fatland, who is a member of the foundation's board of directors, has stated that options are now being examined which will allow the $20-million to provide the most effective protection for agriculture.

2. Effects of Growth on Agriculture

The experience of the Chino Agricultural Preserve illustrates a land use dynamic which affects land at the edge of an expanding urban area: in general, as land becomes suitable for uses more intensive than agriculture, its value increases. And, as the value of the potential uses increases, so does the value of the land.

In the Chino Agricultural Preserve, this has resulted in sharp differences in land value between areas just outside the Preserve (where city services and zoning allow higher-value residential and commercial uses) and areas within (where agricultural restrictions and lack of city services keep land values low). This difference in land values is cited by some dairymen as evidence that they should be allowed to convert their farms to other uses.

This phenomenon is by no means limited to Chino, however. The experiences of farming communities throughout California and the U.S. indicate that, in general, expanding urban areas create conditions at their edges which encourage the further conversion of farmland, thus establishing a new fringe, where the process is repeated.

This pattern is the end result of a number of effects which the expansion of urban areas has on farming. Based on research conducted by the American Farmland Trust, these effects can be grouped into general categories:

"Rurbanization"

The effect of "rurbanization" occurs in areas which are in the early stages of conversion from agriculture to other uses. Basically, a rurbanizing area is marked by a switch from fairly large parcels of a size sufficient to support farming operations (generally larger than 20 acres, but larger for some crops) into smaller units. According to the U.S. Department of Agriculture's Soil Conservation Service, California presently contains almost two million acres of this type of "rurban" or "ranchette" development, in addition to 3.2 million acres of "urban" land. In a study of the Bay Area, it was determined that one acre of land was transformed into a "ranchette" for every acre directly removed from production for development purposes.

In theory, these smaller parcels are established to allow their sale to individual owners who will continue to farm and experience a "rural" lifestyle. In practice, however, these parcels too frequently divide the land into pieces too small to be effectively farmed. The land is taken out of production, often leading to pressures on the local jurisdiction to further subdivide the land into smaller parcels, which are in turn sold to more owners, increasing the urbanization of the land.

Air Quality

Much attention has been paid in recent years to the effects of air pollution on humans. Air pollution's effects, however, are not limited to those it has on humans. Studies conducted by the California Air Resources Board have indicated that damage to crops resulting from high levels of ozone (a major component of smog) result in $333-million in lost revenues each year. Citrus production can decline by 20 percent in the presence of urban levels of ozone; other crops experience drops in production of more than 35 percent at the same level of air pollution. Acid fog, formed when airborne pollutants are distilled out of moisture in the air, can also damage the leaves of all plants, reducing farm yields.

The "Impermanence Syndrome"

As discussed above, rising land values at the urban fringe often lead to the subdivision of land in expectation of its later sale at a higher value. This expectation of imminent sale is considered by many experts to contribute to the "impermanence syndrome," which describes a decline in farm investment as conversion to other uses becomes apparent. For instance, a farmer expecting to sell his land in a few years would be unwilling to make a long-term investment in new equipment.

While this phenomenon is accepted by most observers, and appears to be substantiated by anecdotal evidence, some researchers have examined farmland data nationwide which suggests that the opposite is true: that rising land values may encourage investment. These researchers suggest that, on a nationwide level, farmland data suggests that rising land values encourage not conversion to other uses but to higher value crops (from hay to vegetables, for instance). Rising land values, according to these researchers, provide these farmers with the means to finance the capital investments in equipment and labor to convert to higher value crops.

Even if this new theory is substantiated, it may not accurately describe conditions in San Bernardino County. At any rate, it appears clear than farmland in the County--specifically, farmland at the urban fringe--is in danger of conversion to urban uses.

Vandalism and Other Conflicts

Quite apart from the commonly held notion of the "family farm," modern agriculture is an industry which relies on modern practices to achieve maximum productivity. In many cases, these practices involve side effects acceptable in sparsely populated areas, but objectionable in urban areas. These include the creation of odors, flies, and noise (from equipment which often runs continuously or at late night and early morning hours) which affects residents near farms.

These nuisances generally result in complaints from nearby residents, which often result in pressures on the farmer to reduce the nuisances. The end result can be a drop in farm productivity as the result of increased regulation.

Urban areas can also directly affect farm output simply by increasing the number of persons adjacent to farms who may view farmland either as a recreational area or as a convenient outlet for criminal vandalism.

3. Effects of Agriculture on Wildlife

A substantial portion of the undeveloped open land remaining in the Valley portion of the County is occupied by farmland. And, while these lands represent a substantial resource, it should be noted that agricultural lands generally have a low value as wildlife habitat.

As noted by wildlife biologist James Shaw, "Of all human activities, none have had more impact upon wildlife than agriculture. . . . One generalization stands out clearly: the suitability of farmland for wildlife declines as intensity of agriculture increases."

As happens in the "island habitat" situations discussed earlier, both the number and diversity of species declines as farming increases. One study of bird species in Illinois found that the diversity of species had dropped considerably in this century, from an earlier situation in which 18 species comprised 70 percent of the bird population, to the present day, when only 9 species made up this same portion of the population. Similar results have been noted in other studies.

In terms of creating a Countywide plan of open spaces, therefore, it must be recognized that farmland, while serving

some open space functions, has only a limited value as wildlife habitat. Nevertheless, some measures are available which can increase the value of farmland as habitat.

In general, these measures relate to the creation of those aspects of the natural world--trees, protected places, brush and scrub--which may be lacking in farming areas. For instance, the creation of an untilled area at the boundary of a field (which may include a drainage or irrigation canal) can serve as a wildlife corridor, allowing animals to pass through farming areas. The creation of alternative crop layouts, such as triangular fields, can also provide more of the "edge" habitat which wildlife seeks out, although this type of field is somewhat more difficult to manage.

These physical changes in the structure of farmland, of course, to not change the far-reaching effects of farming which result from the extensive use of pesticides, herbicides, and chemical fertilizers. However, it should be noted that recent research has validated the use of natural wetland areas (native or re-created by design) to remove toxic chemicals from urban run-off.

According to one study, a properly designed wetland area can remove 80 to 100 percent of suspended solids (sediment), 60 to 80 percent of phosphorus, and 40 to 80 percent of total nitrogen (the removal of these chemicals helps prevent the formation of excess algae). The same basin can also stabilize 60 to 80 percent of trace metals. The removal of excessive nitrogen would be of particular value in the Chino Agricultural Preserve.

4. Agricultural Protection Policies

As discussed above, the County of San Bernardino has already adopted a strong farm protection policy, in the form of the Board of Supervisors' decision to retain agricultural land use restrictions in the Chino Agricultural Preserve.

The County's existing policies related to agricultural land preservation are discussed in an earlier section of this report. The following partial listing of other alternative strategies developed by the American Farmland Trust is presented to suggest a range of alternative strategies which could be implemented by the County to increase the effectiveness of its agricultural preservation policies.

Ensure Conformance of County Land Use Policies with Agricultural Preservation

Although County land use policies presently designate large areas for land uses which include agriculture (particularly in sparsely developed regions of the County), other policies also allow the establishment of a wide range of conflicting uses, including residential developments on relatively small lots (see the "rurbanization" discussion above). These policies result in part from the desire of landowners in the County to retain the option to establish non-agricultural uses on their land. However, the end result in many cases has been the pre-emption of agricultural preservation policies with other priorities, resulting in a destruction of the agricultural value of the land. The County may wish to review its policies and determine whether a stronger or reduced commitment to agricultural preservation is desired, and where such efforts should be focused.

Revise the County's CEQA Implementation to Specifically Address Farmland Conversion

Much of the development taking place in the Valley portion of San Bernardino County is occurring on agricultural lands. Agricultural lands are suitable for development for a variety of reasons, including their proximity to existing cities and the general characteristics of farmland (it is generally flat, well-drained, and contains soils which are easily worked), which make it attractive as a building site.

As required by state law, many development projects are subject to environmental review, which may lead either to the preparation of a Negative Declaration of Environmental Impact Report. While state law requires an examination of potential impacts, however, the conversion of farmland is often dismissed as an acceptable impact of a project. Legislation introduced in the 1989 state legislative session (and scheduled to be re-introduced in 1990) would add to CEQA by defining the conversion of a single piece of farmland more than 50 acres in size as a "significant impact," making additional findings necessary to support the conversion. The County may wish to review whether its commitment to agricultural preservation would extend to including this type of requirements in its CEQA implementation.

Adopt LAFCO Policies Discouraging Farmland Conversion

As discussed above, a major threat to the continued viability of farmland is the extension of city boundaries and services into agricultural areas. The extension of city limits and their attendant road system, water and sewer networks, and other amenities, generally makes land suitable for conversion to urban uses.

As the governing body charged with approving the extension of city and service limits (including the limits of water and sewer districts), the Local Agency Formation Commission frequently makes decisions affecting the conversion of farmland to other uses. By approving an extension of city services into a farmland area, for instance, a LAFCO may be giving de facto approval for the conversion of this land out of agriculture.

The County may wish to review whether it should take a position supporting a clear policy on the part of the local LAFCO discouraging the extension of city services into farmland areas unless specific findings can be made (for instance, that no other undeveloped land is available within a city for a given use). The LAFCO in Solano County, for example, has adopted specific policies which require the examination of a number of criteria, including soil type and productivity, and which seek to prevent development of farmland and encourage in-fill development in urban areas.

Support the Formation of Agricultural Land Trusts

While the County has supported the formation of a land trust to administer the $20-million received from Prop. 70, this same type of organization could be encouraged in other areas of the County. Land trusts can provide additional opportunities for farmland protection if they are established as tax-exempt charitable land conservation organizations.

According to the American Farmland Trust, more than 60 land trusts have been formed in California, including 15 which are intended specifically to preserve farmland. One such trust, in Marin County, has purchased or accepted donations of more than 11,000 acres of farmland.

Promote the Local Farm Industry

In some California counties, specific marketing efforts have been made to build public awareness of and support for agriculture and farmland preservation. The counties of Fresno, Placer, Yolo, Sonoma, and Sacramento each have programs in place which sponsor agricultural fairs and events aimed at informing the public of the value of agriculture. This type of education is especially important if the preservation of farmland is included in any type of funding mechanism placed on a ballot in the County--voters must be informed about the benefits which will accrue to them if they are to support an increase in taxes or assessment.

Part of this information program could include educating the public and decision-makers about the costs and benefits of converting agricultural land to other uses. For instance, the American Farmland Trust has concluded, after reviewing a number of studies, that

> "One . . . finding is that farmland loss can cost local government (and therefore taxpayers) money. Development is not always a boon to the local economy, despite the popular notion that it is. . . . agricultural land, unlike residential property, adds little to the cost of public services. Farmland conversion
> also brings environmental effects: air pollution, flooding, as well as loss of scenery, wetlands, and wildlife."

Providing this type of information to the public, if validated by studies specifically tailored to San Bernardino County's own set of land use dynamics, could be helpful in the establishment of grass-roots support for a farmland preservation program.

Establish a "Transfer of Development Rights" (TDR) Program

The concept of transferring development rights, first suggested in the 1970s as a method to preserve historic downtown structures by allowing landowners to capitalize on their property's potential without rebuilding, has also been recognized as an effective farmland (and open space) protection strategy. In general, the concept of transferring development rights is simple: the landowner essentially "sells" the development rights to his property to either a land bank or another landowner. For instance, a

landowner with land suitable for development of ten single family homes could sell the development rights to build these homes to another landowner, who could add these units to those he could otherwise build on his "receptor" parcel.

The advantage to a "TDR" program is that the cost of purchasing development rights is generally lower than buying land outright. However, if a public agency is the purchaser of the development rights (rather than another landowner directly), it must be decided whether this agency will simply buy the rights or serve as a "bank," reselling them to a third party. If the public agency is formed to simply purchase development rights, renewable funding must be available; if the agency intends to re-sell the purchased rights, "receptor" areas capable of supporting increased development densities must be identified.

A related concept is the "conservation easement," which is purchased (or accepted as a donation) by a public agency. The conservation easement also eliminates the development potential of the land, although the development rights are not transferred to another parcel.

Although each requires careful management and the implementation of specific policies and programs, these methods can be effective. The American Farmland Trust reports that Marin and Sonoma counties, working with local groups and trusts, have purchased development rights on more than 15,000 acres of agricultural land. The funds provided to the County as part of Proposition 70 (discussed above) can be used for this type of program, as well as for the outright purchase of land.

It should be noted, however, that purchases of development rights or conservation easements can have negative effects. As discussed earlier, for instance, rising land values, which are generally viewed as a threat to farming, can also provide a windfall of potential capital to a farmer. As land values (and equity) increase, the amount of capital available to a farmer for conversion to high-value crops and changing agricultural practices also increases. While purchase of development rights or easements benefits the immediate owner, the later result is that the land will not appreciate to the same degree as land free from this type of restriction. A subsequent owner, for instance, will see much less appreciation in value, and may have less equity against which to borrow for future improvements.

Other policy options are also available, including:

-- Strengthening the County's commitment to preservation of soil resources through the actions of agencies such as the U.S. Department of Agriculture's Soil Conservation Service and the West End Resource Conservation District.

-- Adopting policies regarding the allocation and preservation of water resources, specifically supporting policies which seek to provide adequate water supplies for agriculture.

These and other options will be explored and included where appropriate in the Expanded Open Space Element.

5. Southern California Agricultural Land Foundation

As discussed earlier, the County has contracted with the nonprofit Southern California Agricultural Land Foundation to administer the $20-million received by the County under Proposition 70. The function of this Foundation will be to protect the dairy operations in the Chino Agricultural Preserve from encroachment by urban uses and ultimate conversion out of farming.

Based on discussions with County officials and the Foundation, it appears that a substantial opportunity exists to coordinate its efforts with other Countywide open space preservation efforts. This is of particular importance to the Foundation, since the $20-million provided under Proposition 70 is not enough to achieve the overall objective of preserving the Chino dairy industry.

II. INFORMATION REFERENCES

This section of the Background Appendix provides a reference to information sources for open space information and mapping. In some cases, some or all sources of information on a particular open space issue are maintained by agencies outside the County; in these cases, documents prepared by these agencies are available at County Planning.

The following list corresponds generally to the order in which information is presented in the Open Space Element of the General Plan, although letters and numbers have been changed. For information on open space issues and policy direction, please refer to the Open Space Element.

A. Major Federal and State Open Space Resources

For the locations of these resources, refer to the Open Space Background Report. Information on the locations of these areas is shown in the U.S. Forest Service's San Bernardino National Forest Land and Resources Management Plan, the Bureau of Land Management's California Desert Conservation Area Plan, and in the Jurisdictional Control map in the Overlay map system.

1. Bureau of Land Management

Areas under the jurisdiction of the Bureau of Land Management are mapped in the BLM's California Desert Conservation Area Plan.

2. United States Forest Service (USFS)

The boundary of the national forests in the San Bernardino mountains are shown on the Resources Overlay. Exact boundaries of federally controlled lands within the national forest are shown on Overlay maps which provide jurisidictional control information.

3. University of California Natural Reserve System

Detailed mapping of the locations of these reserves is available from the University of California system.

4. National Monuments

The boundaries of national monuments are available in maps complied by the Bureau of Land Management and the National Park Service. Some information on the boundaries

of national monuments and landmarks is contained in the "Jurisdictional Control" layer of the Overlay maps.

The boundaries of all federal features in the County (National Monuments, military reservations, and the like) have been mapped, but it should be noted that some dispute exists regarding the exact boundaries of these areas, due in some cases to the age and dubious accuracy of the original surveys used to establish the boundaries.

The locations of wildlife refuges and preserves are mapped in the San Bernardino National Forest Land & Resource Management Plan and the California Desert Conservation Area Plan. Wildlife preserves which are related to regional parks are mapped in general terms in the Regional Parks Strategic Master Plan, 2010: Our Parks Future.

Additional sources of information on sensitive wildlife areas include the University of California, which maintains wildlife reserves, and the Southern California Association of Governments, which identified significant wildlife areas in a 1975 regional Conservation and Open Space Plan.

The State Department of Fish and Game has also compiled a report, Important Sites of California's Natural Diversity - South Coast Area Special Edition (Lands and Natural Areas Project Administrative Report 90-1), which identifies and describes significant areas of natural diversity.

Other agencies which have prepared maps of biologically sensitive areas include:

-- California Natural Areas Coordinating Council Inventory of Natural Areas
-- California Department of Parks and Recreation Landscape Preservation Study
-- National Park Service National Natural Landmarks Program
-- U.S. Fish and Wildlife Service California Important Fish and Wildlife Habitat: An Inventory
-- Southern California Association of Governments Conservation and Open Space Plan, published in 1975.

B. Nature Conservancy Preserves

Specific information on the locations of these preserves is not currently maintained by the County, but may be obtained from the Nature Conservancy.

C. Specialized Habitats on Private Lands

A listing of major areas of habitat known to occur on private lands is shown in the Open Space Element.

D. Other Natural Resources Areas of Biotic Significance

Manual maps of the locations of these features are found in a variety of documents, primarily the San Bernardino National Forest Land & Resource Management Plan and the California Desert Conservation Area Plan. Some of these features are also identified on quadrangle maps prepared by the U.S. Geologic Survey.

E. Hot Springs

Hot springs in the County have not been extensively mapped. However, a 1973 Conservation and Open Space Report prepared by the County contains a general map of known hot springs. Hot springs may also be mapped on USGS quad sheets.

F. Mountainous Terrain

The location of mountainous terrain throughout the County is not available in a single location. Mountainous areas in the Desert region are shown in a computer map database prepared specifically for that region. Where computerized mapping is not available, mountainous terrain may be determined by reviewing USGS quad sheets; no mapping specifically identifying mountainous areas has been compiled for the Valley and Mountain regions. The general locations of areas of mountainous terrain are also indicated in the County's 1973 Conservation and Open Space Report.

G. Sand Dunes

Since most dunes are located in the Desert region, two primary information sources for the resource are a special computer map database for the Desert region and the BLM's California Desert Conservation Area Plan.

In the Valley region, near the city of Colton, remnants of once-widespread dunes which continue to support threatened or endangered species are shown on the Resources Overlay. In addition, the locations of sandy soils which could create dunes are shown in soil surveys compiled by the U.S. Department of Agriculture Soil Conservation Service.

H. Lava Flows

Since lava flows are located in the Desert region, information on this resources is available in a computer map database for the Desert region. The general locations of lava flows are also noted in the 1973 Conservation and Open Space Report and in the BLM's California Desert Conservation Area Plan.

I. Cinder Cones

Since cinder cones are located in the Desert region, information on their location is available in a computer map database for the Desert region. Cinder cone locations are also shown in the 1973 Conservation and Open Space Report and to some extent in the BLM's California Desert Conservation Area Plan.

J. Dry Lakes/Playas

Since dry lakes are primarily located in the Desert region, the primary source of information on this resource is a computer map database for the Desert region. Dry lakes are also shown on USGS quadrangle maps and on commercially available maps (such as Thomas Guides).

K. Fragile Soils

The locations of fragile soil areas supporting special plants and animals are discussed in the Biological Background Report of the General Plan. In addition, manual maps of areas with fragile soils have been produced by the USDA Soil Conservation Service, although these maps cover portions of the County only. In individual cases, soil studies may be necessary to determine whether fragile soils exist. The County's 1973 Conservation and Open Space Report also outlines general areas in which these soils are found.

L. High Erosion Hazard Soils

The location of areas with erosion-prone soils is shown on maps prepared by the USDA Soil Conservation Service. General areas with "unstable" soils are also shown in the 1973 Conservation and Open Space Report.

M. Perennial and Intermittent Streams

The locations of perennial and intermittent streams are shown in a computer map database for the Desert region, and throughout the County on quadrangle maps prepared by the U.S.

Geologic Survey.

N. Groundwater Recharge Areas

The locations of surface groundwater recharge areas are shown in maps maintained by the County Flood Control District, including the "Stormwater Facilities Map" and the "Surface Drainage Map."

O. Lakes and Reservoirs

In the Desert region, lakes and reservoirs have been mapped in a computer map database. In the Mountain region, where lakes are privately owned, the general outline of shorelines can be determined from the "Parcel Base Map" of the Overlay maps. Throughout the County, the locations of lakes and reservoirs can also be determined by reviewing USGS quadrangle sheets and commercially available maps, such as Thomas Guides.

P. Wetlands

Information on known wetlands is available from several sources.

Wetland features in the Desert region, which includes much of the streambed of the Mojave River, are shown on a computer map database for the Desert region.

Elsewhere in the County, known wetlands have been identified and manually mapped by the U.S. Fish and Wildlife Service as part of that agency's National Wetland Inventory Program. However, this mapping should be used with caution, since the information is available at an inexact scale and typically shows only large wetland areas. In addition, San Bernardino County wetlands, which in other areas would not be considered "wet," are often not shown on the USFWS maps, because they do not fit standard classifications.

Many wetlands may exist in the County which have not been specifically surveyed and mapped.

Q. Limited Habitat Types: Chaparral, Conifer Forest, Woodland, Riparian Areas

The location of vegetative and habitat types is available in the Biological Background Report of the General Plan, on the Biotic Resources Overlay, and on manual maps prepared by the U.S. Forest Service and the Bureau of Land Management.

An addition source of information is the State of California Natural Diversity Database (CNDDB), which maintains records and manual maps of the locations of all known occurrences of threatened, rare, and endangered plant and animal species. These locations are shown on overlays which align with USGS quadrangle sheets, and can be used to determine the general known locations and ranges of special plants and animals. Special plants and animals can be expected to occur in many locations not yet surveyed or mapped.

R. Joshua Trees

Although the locations of all stands of Joshua trees are not mapped, the locations of significant stands are shown in a manual map, "Unusual Plant Assemblages," included in the Bureau of Land Management's California Desert Conservation Area Plan. In general, it can be assumed that Joshua trees may be present on most sites in the desert and the desert/mountain interface.

S. Champion Lodgepole Pine

Locations of areas containing Champion lodgepole pines are shown in the BLM's California Desert Conservation Area Plan and discussed in the Biological Background Report of the General Plan.

T. Large Mammals and Raptors: Beaver, Mountain Lion, Bear, Golden Eagle

Locations of habitat areas for these species are shown in the Biological Background Report. Locations of habitat areas for these species are also mapped in the San Bernardino National Forest Land & Resource Management Plan and the California Desert Conservation Area Plan. The County's Mountain Planning Team also maintains records on the locations of beavers.

U. Spotted Owl

Locations of spotted owls and habitat areas are shown in the U.S. Forest Service's San Bernardino National Forest Land and Resources Management Plan, and from other sources, including the State of California Natural Diversity Data Base. In general, these include areas in the San Bernardino National Forest, including some areas of privately owned land.

V. Bighorn Sheep

Locations of Bighorn sheep habitat areas are shown in the U.S. Forest Service and BLM plans, as well as in other sources, such as the State of California Natural Diversity Data Base. An additional source of general information on Bighorn sheep habitat areas is the 1973 Conservation and Open Space Report.

W. Stevens Kangaroo Rat

Locations of Stephens kangaroo rat (SKR) habitat are shown in the Biological Background Report prepared for the General Plan, as well as the 1973 Conservation and Open Space Report. Locations of known SKR occurrence are also available from the State Natural Diversity Data Base.

X. Southern Rubber Boa

The Biological Background Report and the County's 1973 Conservation and Open Space Report indicate the general location of habitat for the Southern Rubber Boa. Although this species is identified by the CNDDB, maps produced by this agency do not indicate the location of known occurrences to prevent capture of individuals.

Y. Mojave Ground Squirrel

The general location of the range of the Mojave ground squirrel is mapped in the Biological Background Report and the 1973 Conservation and Open Space Report. General information on the location of known ground squirrel occurrences is also available from the CNDDB. The BLM's California Desert Conservation Area Plan also maps the range of this species.

Z. Yuma Clapper Rail

The general location of the Yuma clapper rail is described in the Biological Background Report and the 1973 Conservation and Open Space Report; information on this species is also available from the CNDDB.

AA. Sonora Lyre Snake

The general location of the Sonora lyre snake is described in the Biological Background Report and the 1973 Conservation and Open Space Report; information on this species is also available from the CNDDB.

BB. Desert Tortoise

The habitat range of the Desert tortoise has been mapped by both the Bureau of Land Management, (Interim Tortoise Habitat Category Maps) and the U.S. Fish and Wildlife Service, Class Maps) which has the responsibility to protect this species. These maps differ to some extent, representing the purpose of differing agencies. There is, however, cooperation and a sharing of information between Federal as well as State agencies. Management for the tortoise has intensified this issue due to its Federal and State listing.

The 1973 Conservation and Open Space Report maps a very general range for this species, but should not be used, since that report's map conflicts in many areas with more current information.

CC. Least Bells Vireo

Habitat areas for the Least bells vireo are mapped in the Biological Background Report, and are available from the CNDDB. Areas in the mountains and desert which support this species are also mapped by the U.S. Forest Service and the BLM.

DD. Wild Burros

Wild horse and burro management areas within the County are mapped in the BLM's California Desert Conservation Area Plan.

EE. Special Fish

San Bernardino County is home to a variety of threatened and edangered fish species, including several which exist only in the County. These species include the humpback sucker, bonytail, colorado squawfish, mojave chub, relict brine shrimp, relict crayfish, Tecopa pupfish, and the unarmored 3-spine stickleback (discussed earlier in this section).

The locations of these species are mapped in the BLM's California Desert Conservation Area Plan and the U.S. Forest Service's Management Plan. Information on these species is also available from the State CNDDB.

FF. U.S. Forest Service Management Zones

U.S. Forest Service Management Zones are mapped in the San Bernardino National Forest Land & Resource Management Plan.

GG. SCAG Areas of Regional Significance and Concern

As part of its 1975 regional plan of open space areas, the Southern California Association of Governments identified a number of areas within San Bernardino County as critical open space areas.

These areas, which are listed in this Background Report, are mapped in SCAG's 1975 plan, although the level of detail is in many cases not specific enough to provide useful planning information. Many of these areas have also been identified by the Bureau of Land Management and the U.S. Forest Service.

HH. Mineral Resources

Information on the location of mineral resources in San Bernardino County is available in hard copy form on maps Mineral Resource Zone maps produced by the State of California Geologist, which overlay this information on USGS quad sheets. In the Desert region, this information is available in a computer map database. In addition, the Bureau of Land Managements' (BLM) California Desert Conservation Area Plan contains manual maps identifying areas of known and potential mineral resources, as well as potential leasable salable minerals.

The locations of major mine sites is also shown on quadrangle maps prepared by the U.S. Geologic Survey (USGS), although the age of the data on these maps may affect the accuracy of this information. The locations of economic mineral resources are identified on manual maps in the BLM's California Desert Conservation Area Plan.

Since mines in the County require a conditional use permit, an additional source of potential information is the County's files. Locations of maps may be obtained from the C.U.P. files.

II. Water Conservation and Management Areas

There are four state regional water quality control boards which manage the quantity and quality of local groundwater resources. They are the Lahontan, Colorado, Santa Ana, and Los Angeles Regional Boards. San Bernardino County and the underlying groundwater aquifers provide for domestic water storage on both a local and regional basis. The replenishment of groundwater occurs both artificially and naturally. Imported water from northern California is recharged into local aquifers throughout the County.

Various facilities for handling imported water include the California Aqueduct (which feeds Silverwood Lake and then extends into Riverside County to Lake Perris) and the Colorado River Aqueduct (which feeds Gene Wash Reservoir and Copper Basin Reservoir near Parker Dam). These waters are managed by five state water contractors: the Mojave Water Agency, Chino Basin Municipal Water District, the Crestline/Lake Arrowhead Water Agency and the Metropolitan Water District of Southern California. These agencies, along with local purveyors, have established manmade lakes for water conservation and recreational purposes. These include Lake Silverwood, Lake Arrowhead, and Big Bear Lake. Lake Gregory is managed solely for recreation purposes.

JJ. Agricultural Lands

The location of areas in the Valley currently being farmed (at a resolution of approximately 20 acres) is available on hard copy maps from the U.S. Department of Agriculture (USDA) Soils Conservation Service, updated annually. The County of San Bernardino Department of Agriculture maintains annual records of agricultural production.

The location of lands containing prime and other levels of agricultural soils are identified on maps produced by the State of California Department of Conservation.

The USDA has also prepared detailed soils surveys for portions on the County, including: Soil Survey of San Bernardino County, Southwestern Part and Soil Survey of San Bernardino County, Mojave River Area. These documents contain manual maps which identify specific locations of areas containing various soil types; these soil types are identified in the reports for their agricultural suitability.

KK. Grazing Areas

Grazing area locations are available from the Bureau of Land Management and the U.S. Forest Service. The BLM's California Desert Conservation Area Plan and the U.S. Forest Service's San Bernardino National Forest Land & Resource Management Plan and Environmental Impact Statement both identify grazing areas.

Lands containing existing vegetation suited to the grazing of livestock are also identified on manual maps entitled "San Bernardino County Important Farmland," compiled by the State of California Department of Conservation. These maps do not identify whether grazing is occurring on identified lands, simply

whether the land is generally suitable for this use.

Since grazed areas change from year to year, exact mapping may not be available.

LL. Agricultural Preserves

Agricultural Preserves and Williamson Act contracts are utilized for the protection and enhancement of agricultural lands. There are 22 preserves containing more than 36,000 acres within the unincorporated area of the County. The County is noted for its large dairy preserve in the south Chino area. Citrus farming, once widespread, is currently declining in the Valley portions of the County. There still remain large blocks of active viable citrus farms predominantly in the east Valley region. The Desert region also provides for a multiple of agricultural uses, principally along the Mojave River extending from Silverwood Lake to the Newberry Springs area. As noted in the Soils/Agriculture section of the General Plan, the establishment of new agricultural operations in the desert may face severe limitations in available water supply and quality.

MM. Commercial Fisheries

A commercial fishery, as defined by the State Department of Fish and Games, involves the taking of fish from the wild for profit. San Bernardino County (a relatively dry County) is not the home of any major commercial fishing operations. There are, however, several small fish farms in the County. These small businesses raise exotic fish such as koi and species of rainbow trout, large mouth bass and, most commonly, channel catfish. They are sold to consumers for food or to stock private farm ponds. Basically, they are considered a form of specialty agriculture or aquaculture. Locations of these "fish farms" may available in the County's business license files.

NN. Major Recreation Resources in San Bernardino County

1. Regional Parks

County Regional Parks, which are described in detail in the Regional Parks Strategic Master Plan, 2010: Our Parks Future, are shown by location on the Resources Overlay. Specific information regarding the boundaries of regional parks is available from the Regional Parks Department.

2. Community Parks

Locations of community parks are mapped by individual jurisdictions (in the case of parks provided by cities) or the Department of Special Districts (in the case of parks provided by the County through a County-governed special district). In addition, several independent special districts exist in the mountain communities and the high desert which maintain mapping of the local parks they provide.

3. Districts and Service Areas with Park and Recreation Powers

Throughout the County, local recreation facilities, which provide recreational open space, are provided by independent and board-governed special districts. These districts typically collect an annual assessment on land within their boundaries, which is then used for the acquisition and operation of park facilities and recreation programs. Districts currently providing park and/or recreation facilities are listed in the Open Space Element of the General Plan. Mapping of the boundaries of some special districts is provided on the Infrastructure Overlay map; County department of Special Districts can provide more detailed information on the boundaries of districts.

Mapping of the boundaries of special districts is available from the County Department of Special Districts.

4. Bike Routes

Maps of bike routes may be obtained from individual cities.

5. OHV Areas

Off-Highway Vehicle (OHV) areas in the desert under the jurisdiction of the BLM are shown in the California Desert Conservation Area Plan.

6. Points of Public Access to Lakeshores, Rivers, and Streams

Points of public access to waterways are difficult to map, given the ownership pattern which generally exists adjacent to the County's lakes, rivers, and streams. Specifically, many lakes in the County are man-made, and therefore open to public access only at controlled locations. No concise map exists which identifies all points of public access to these features. A summary inventory of major public access opportunities to bodies of water is provided in the Open Space Element.

7. Ski Areas

Ski areas within the County are generally located on land under the control of the U.S. Forest Service. Mapping of ski areas in the national forest is available in the San Bernardino National Forest Land and Resource Management Plan and on USGS quadrangle maps.

8. Hang Gliding Areas

Hang gliding areas have been provided by the U.S. Forest Service in the San Bernardino National Forest through its special use permit process. Mapping of hang gliding areas in the national forest is available in the San Bernardino National Forest Land and Resource Management Plan.

OO. Scenic Highways

In recognition of the visual quality of the areas through which they pass, the following roads are designated scenic routes by the County and, in some instances, by the California Department of Transportation (Caltrans). Major roadways, which may include some roadways designated as scenic routes, are shown on the Overlay maps. State scenic routes are mapped by the California Department of Transportation (CalTrans). In addition, the length of the "Rim of the World Highway," which includes portions of Higways 138, 18, and 38, has been officially designated by the U.S. Forest Service as a Scenic Byway.

PP. BLM Scenic Area

The Bureau of Land Management (BLM) has designated a vast area of 1.5 million acres in the east central portion of the County as the **East Mojave National Scenic Area.** This Scenic Area is shown on mapping included in the California Desert Conservation Area Plan, which is on file at the Office of Planning.

As part of its **Back Country Byways** program, the BLM has also begun a process to designate a number of roadways in remote desert areas as Back Country Byways, a designation which is intended to alert motorists to the scenic quality of these less-traveled routes. One of these routes, the Wild Horse Canyon Back Country Byway, was designated as the nation's first Byway. A complete listing of this and other Back Country Byways is available from the BLM.

QQ. Major Open Space Areas for Public Health and Safety

1. Principal Faults (Active and Potentially Active)

The locations of known principal faults Countywide are available in digitized form on the Hazards Overlay. Manual maps prepared by the State Geologist are also available.

2. Severe Soil Limitations for Septic Tanks

Soil types for some portions of the County have been mapped by the USDA and are shown in that agency's publications, Soil Survey of San Bernardino County, Southwestern Part and Soil Survey of San Bernardino County, Mojave River Area. Those publications identify soil types which impose limitations on the installation of septic tank/leach field systems, although this information must be interpreted; no specific map delineating only areas with septic limitations has been compiled.

The 1973 Conservation and Open Space Report can also be used as a source of general information regarding the location of areas with septic tank limitations, but should not be used as a definitive source. As a general practice, soil studies on specific sites are required by the County whenever a potential for septic tank limitations is believed to exist.

Information on areas with septic tank limitations is complete only in those portions of the County mapped by the USDA. This information is available in manual maps only; the Overlay maps do not contain soil types.

3. Slide Prone Areas

Slide-prone areas in some portions of the County are shown on the Hazards Overlay. This information is also mapped at a general level in the 1973 Conservation and Open Space Report.

This information has been mapped for some portions of the County with a high potential for slide hazard; a complete mapping covering the entire County has not been completed. As a general rule, the County requires geotechnical studies for individual projects in areas subject to potential slide hazards.

4. Dams

The locations of dams throughout the County are mapped in the Hazard Overlay. Dam locations can also be found on USGS quad sheets. This mapping is completely digitized in the Overlay system, and is also available in manual form.

Areas below dams which are subject to catastrophic inundation are shown on the Hazards Overlay map.

5. Channels

The location of channels is available in computer map database of the Desert region. Manual mapping of channels in all portions of the County is available on USGS quadrangle maps, although older maps may not accurately show existing features.

The 1973 Conservation and Open Space Report also shows the general location of channels, although substantial construction of flood control facilities has taken place since that time, making the 1973 maps unreliable in some areas. A more accurate source of channel information outside the Desert region is the County Flood Control District's Regional Flood Control Maps, which show the locations of all County-maintained channels.

6. Levees

Mapping of levees is available in a computer map database for the Desert region. Levees in other regions of the County is available on USGS quadrangle sheets and manual maps maintained by the County Transportation/Flood Control. The 1973 Conservation and Open Space Report also shows levee locations, although flood control facility construction since that report's completion may make those maps unreliable in some areas. The County Flood Control District's maps of facilities can be used as a more accurate indication of levee locations.

7. Areas Subject to Flooding

Areas subject to flooding are identified on the Hazards Overlay, based on mapping prepared by the Federal Emergency Management Agency (FEMA).

8. Prado Dam Inundation Area

Mapping of the area subject to inundation is maintained by the County of San Bernardino Transportation/Flood Control District.

9. Seven Oaks Dam "Borrow Sites"

The locations of the borrow areas for the Seven Oaks Dam area available from the U.S. Army Corps of Engineers and the County of San Bernardino Transportation/Flood Control District.

10. Aqueducts (State water project, Colorado River, etc.)

Aqueducts are shown on USGS quad sheets and on some commercially available maps (such as Thomas Brothers Guides). General maps of aqueduct facilities are also available from a variety of sources, although these maps cannot be used to accurately locate these facilities. Individual agencies in charge of aqueducts (such as the Metropolitan Water District) can also be contacted for maps of their facilities.

This information can be compiled from outside sources, but is not available in a single map.

11. Utility Easement Corridors, Railroads, and Major Pipeline Easement Corridors

The locations of energy and utility corridors are available from a variety of sources, including the County Assessor's Office, which maintains detailed records of all easements and fee-owned parcels under the control of utility companies. For the Desert region, the BLM's California Desert Conservation Area Plan contains a manual map of existing and proposed transmission lines, corridors, power plants, and communication sites. This information is also available for the Desert region in a computer map database. The locations of railway lines are shown on publicly available road maps. Some information on rail corridors within the Valley region is available in the Overlays where these features form jurisdictional boundaries; however, the Overlay maps do not indicate the width or status of the corridors.

12. Landfills

The locations of active landfills within the County is contained in the County's Solid Waste Management Plan (CoSWMP) and in the Infrastructure Overlay. The locations of inactive landfills (which may have been established in the past without proper permitting) are in many cases not known. Many of these landfills are found within the incorporated boundaries of cities.

Mapping of the locations (but not boundaries) of existing landfills is complete, and is contained in the CoSWMP in the Overlay maps. Mapping of closed landfills may not have been accomplished, and may need to be completed on a case-by-case basis as these landfills are discovered.

13. Airports/Military Facilities

Information on airports is contained in the "Transportation/ Circulation" section of the General Plan. Airport locations are mapped in the Hazards Overlay.

III. CORRIDOR/POLICY AREA IDENTIFICATION

The following are descriptions of the locations and resources within each of the wildlife corridors and policy areas identified on the Open Space Map of the Resources Overlay. A detailed breakdown of acreage and estimated acquisition costs associated with areas in which land purchase may be a primary strategy is shown in Table D, in the Addendum to this Background Report.

The identification of many of the corridors and areas listed below was achieved in consultation with Mr. Steve Loe, wildlife biologist for the San Bernardino National Forest of the U.S. Forest Service. Other areas were identified based on knowledge of significant existing resources, adjacency to areas within the Bureau of Land Management's California Desert Conservation Area, and on the principle of providing "wildlife corridors" to connect significant natural areas with each other.

As additional knowledge regarding the status of existing features becomes available or is made available in usable form in the County's automated mapping system, the listing of wildlife corridors and policy areas may be revised or expanded.

1. Day Canyon

Geographic Description This corridor extends northward from the boundary of the national forest along the alignment of Day Canyon.

Resources Identified The canyon and its associated creek contain riparian areas and many sensitive species, including wild brown trout (all fish-supporting streams in the County are rare and worthy of protection). Substantial private inholdings. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)
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Open Space Objectives This area should be maintained both for its habitat values and as a dispersion corridor for wildlife to and from the national forest and open space areas within the City of Rancho Cucamonga.

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

2. East Etiwanda

Geographic Description This corridor includes the southern portion of Etiwanda Canyon, north of the national forest boundary, where private inholdings exist.

Resources Identified The canyon contains a stream and riparian habitat, and supports several sensitive species, including wild brown trout (all fish-supporting streams in the County are rare and worthy of protection). Substantial private ownership along the canyon alignment. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives This area should be maintained both for its habitat values and as a dispersion corridor for wildlife to and from the national forest and open space areas within the City of Rancho Cucamonga.

3. Lytle Creek

Geographic Description This corridor follows the alignment of Lytle Creek from the boundary of the national forest northward to approximately Miller Narrows.

Resources Identified This area contains riparian habitat and supports several sensitive species, including wild rainbow trout (all fish-supporting streams in the County are rare and worthy of protection). Substantial private ownership. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives This area should be maintained both for its habitat values and as a dispersion corridor for wildlife to and from the national forest and other open space areas outside.

4. Middle Fork Lytle Creek

Geographic Description This corridor follows the alignment of the Middle Fork of Lytle Creek from Miller Narrows northward.

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

Resources Identified This area contains riparian habitat and supports several sensitive species, including wild rainbow trout (all fish-supporting streams in the County are rare and worthy of protection). Some private ownership in the southern reaches. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives This area should be maintained both for its habitat values and as part of a larger dispersion corridor system for wildlife to and from the national forest and other open space areas outside.

5. North Fork Lytle Creek

Geographic Description This corridor extends northward from Miller Narrows to approximately Chalk Peak.

Resources Identified This area contains riparian habitat and supports several sensitive species, including wild rainbow trout (all fish-supporting streams in the County are rare and worthy of protection). Substantial private ownership in the southern reaches. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives This area should be maintained both for its habitat values and as part of a larger dispersion corridor system for wildlife to and from the national forest and other open space areas outside.

6. South Fork Lytle Creek

Geographic Description This corridor follows the alignment of the South Fork of Lytle Creek northward from Miller Narrows into the national forest.

Resources Identified This area contains riparian habitat and supports sensitive species, including wild rainbow trout (all fish-supporting streams in the County are rare and worthy of protection). Some private ownership at the base of the Creek Fork. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

Open Space Objectives This area should be maintained both for its habitat values and as a part of a large dispersion corridor system for wildlife to and from the national forest and other open space areas outside.

7. Lone Pine Canyon

Geographic Description This corridor follows the alignment of Lone Pine Canyon northward from approximately Blue Gut to approximately Clyde Ranch.

Resources Identified Riparian in lower half. Forest Service and Fish & Game manage deer in entire canyon (deer live in and move through the canyon). Substantial private ownership along entire canyon. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives This area should be maintained both for its habitat values and as a part of a large dispersion corridor system for wildlife to and from the national forest and other open space areas outside.

8. Cajon Wash

Geographic Description This area includes a large area along the Cajon Wash northward from approximately Devore to Mormon Rocks and south to the Santa Ana River.

Resources Identified Cajon Creek supports a native fishery and contains significant riparian vegetation. Least bells vireo habitat exists in this area. Habitat for endangered plants found in the past still these species have not been found in recent surveys. The Santa Ana River in this area supports the Santa Ana River Speckled dace, a fish listed as "Of Special Concern" by the State of California (all fish-supporting streams in the County are rare and worthy of protection). Animals, including large mammals such as bear and deer, regularly disperse across the Wash from the San Bernardino to the Angeles National Forest. Substantial private ownership exists throughout this area. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

Open Space Objectives Cajon Wash is an open space area of substantial importance, and should be maintained as a habitat area and a wildlife dispersion area.

9. Cleghorn Canyon

Geographic Description This corridor extends westward from the Cajon Wash along the alignment of Cleghorn Canyon, ultimately connecting with Corridor 13.

Resources Identified This corridor is part of dispersion network across the I-15 Freeway, and according to the U.S. Forest Service the most important large mammal corridor between Angeles and San Bernardino forests. Private ownership exists at the mouth of the canyon. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives This area should be maintained as a dispersion corridor to ensure species and genetic diversity within the national forest.

10. Crowder Canyon

Geographic Description This corridor follows the alignment of Crowder Canyon northward from the junction with Cajon Creek to approximately Summit. (Portions of Sections 24, 25, and 36, R6W T3N, and Section 19, R5W, T3N.

Resources Identified This area contains riparian habitat and potential habitat for the endangered Least bells vireo. Substantial private ownership exists as inholdings in the national forest. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Open space should be maintained in this area to preserve its habitat values.

11. Cajon Wash Tributary

Geographic Description This corridor, a tributary to Cajon Creek, extends through portions of Sections 22 and 27, R6W T3N.

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

Resources Identified This area contains riparian and other important habitat, which are threatened by private inholdings. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives This area should be maintained as open space to preserve its habitat values and provide a dispersion area for wildlife.

12. Little Horsethief Canyon

Geographic Description This corridor follows the alignment of Little Horsethief Canyon from approximately Section 32, R5W T3N, to the junction with the Mojave River, Section 31, R4W T3N.

Resources Identified This area contains important riparian habitat, and is linked to the Mojave River. Substantial private ownership within the national forest along the southern reaches. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives This area should be maintained as open space to preserve its habitat qualities and to continue to provide a dispersion link for wildlife to the Mojave River.

13. Mojave River Headwaters

Geographic Description This corridor follows the alignment of the Mojave River headwaters from approximately Cleghorn Pass to Lake Silverwood. (Sections 1, 2, 3, 4, R5W T2N). This corridor connects with Corridor 9.

Resources Identified This area contains riparian habitat, and is an important habitat area for deer. Substantial private ownership. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives This area should be maintained as open space to preserve habitat values. Connection to the Mojave River should be maintained.

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

14. Lake Silverwood

Geographic Description This area generally describes the environs of Lake Silverwood.

Resources Identified The area around Lake Silverwood is used as a seasonal perching area by the endangered Bald eagle. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Maintain perching sites and habitat for the Bald eagle, and habitat values for other species.

15. Mojave River

Geographic Description This corridor follows the alignment of the Mojave River from Lake Silverwood northward to the Hesperia area. (See also No. 61.)

Resources Identified The Mojave River, which is the major perennial river in the desert region, is an area of extreme biologic importance, containing rare desert riparian habitat (including habitat capable of supporting the endangered Least bells vireo). The Mojave River in this area supports fish, and is therefore worthy of protection. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives The entire length of the Mojave River should be maintained as open space to provide needed riparian habitat for desert species. Dispersion corridors should be provided along the river through urban areas.

16. Grass Valley Creek

Geographic Description This corridor follows the alignment of Grass Valley Creek from the national forest to its junction with the Mojave River (Sections 23, 26, 36, R4W T3N). This corridor connects across the national forest with Corridor 20.

Resources Identified This area contains riparian habitat and potential habitat for the Least bells vireo, as well as the native Arroyo chub fish, which is listed as a "Sensitive Species" by the U.S. Forest Service (all fish-supporting streams in the

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County are rare and worthy of protection). The creek serves as a dispersion corridor to and from the national forest. Private ownership outside the national forest. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives This area should be maintained as open space to preserve habitat values and wildlife dispersion.

17. Deep Creek Tributary and Mojave River

Geographic Description This area is located in portions of Sections 18, 19, and 20, R3W T3N, along the alignment of the tributary to Deep Creek.

Resources Identified This area contains riparian habitat and habitat for the endangered Least bells vireo, as well as the native Arroyo chub fish, which is listed as a "Sensitive Species" by the U.S. Forest Service (all fish-supporting streams in the County are rare and worthy of protection). The creek serves as a dispersion corridor to and from the national forest. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives This area should be maintained as open space to preserve habitat values and wildlife dispersion.

18. Spotted Owl Habitat

Geographic Description This area includes areas of old-growth forest which provide habitat suitable for the Southern Spotted Owl, generally in and around Jobs Peak, Cedarpines Park, Valley of Enchantment, Crestline, and Lake Gregory.

Resources Identified This area contains good habitat for the Spotted Owl within canyons. Substantial private ownership and heavy urbanization. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Habitat for the Southern Spotted Owl and other species should be maintained.

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

19. Waterman Canyon

Geographic Description This corridor follows the alignment of Waterman Canyon northward from the City of San Bernardino into the national forest.

Resources Identified Waterman Canyon contains riparian habitat, as well as good habitat values for deer. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Open space should be maintained in this area to preserve habitat values and wildlife dispersion.

20. Strawberry Creek

Geographic Description This corridor follows the alignment of Strawberry Creek from approximately the City of San Bernardino northward into the national forest (Includes Sections 12, 13, 14 R4W T1N, Section 7, R3W T1N) and ultimately connects across the national forest to Corridor 16.

Resources Identified This area contains important riparian habitat. Substantial private ownership along entire length. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Open space should be maintained in this area to preserve habitat values.

21. Lake Arrowhead

Geographic Description This area generally describes the environs of Lake Arrowhead.

Resources Identified The area around Lake Arrowhead is used as a seasonal perching area by the endangered Bald eagle. Substantial private ownership and extensive urbanization have occurred in the area around the lake. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

Open Space Objectives Maintain perching sites and habitat for the Bald eagle, and habitat values for other species.

22. Dispersion Corridor

Geographic Description This corridor is located generally between the urbanized areas of Lake Arrowhead and Running Springs. Substantial private ownership. Includes--among others--Sections 17, 18, 19, 20, 30, 29, R2W T2N, and Sections 13, 23, 24, 25, 26, 27, R3W T2N. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Resources Identified This area is important as the last major undeveloped portion of the mountain rim, and provides crucial habitat and dispersion for animals moving between the northern and southern exposures of the national forest.

Open Space Objectives Wildlife dispersion through this corridor should be maintained.

23. Deep Creek

Geographic Description This corridor follows the alignment of Deep Creek from the vicinity of Running Springs northward through the national forest.

Resources Identified Deep Creek is an important habitat area of rich species diversity, and is an state-designated "Wild Trout Stream." Some private ownership occurs in the vicinity of Running Springs. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives This area should be maintained as a wildlife habitat and dispersion area.

24. City Creek

Geographic Description This corridor follows the alignment of City Creek from its headwaters to the junction with the Santa Ana River.

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

Resources Identified City Creek contains important riparian habitat and a link between the national forest and the Santa Ana River. The endangered Santa Ana River Woolystar sighted along creek, which also supports wild trout and native fish, including the Santa Ana Sucker, which is listed as "Sensitive Species" by the U.S. Forest Service (all fish-supporting streams in the County are rare and worthy of protection). Substantial private ownership and urbanization has occurred along the southern reaches of the creek. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives City Creek should be maintained for its habitat values, and as an important link between the Santa Ana River and the national forest.

25. Plunge Creek

Geographic Description This corridor follows a portion of Plunge Creek from the national forest to the Santa Ana River.

Resources Identified Plunge Creek contains riparian habitat, and provides an important link from the national forest to the Santa Ana River. Private ownership exists in the southern reach of the creek and outside the national forest. The creek also supports native fish, including the Arroyo chub, which is listed by the U.S. Forest Service as a "Sensitive Species" (all fish-supporting streams in the County are rare and worthy of protection). (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Plunge Creek should be maintained as an open space area to preserve habitat and wildlife dispersion.

26. Bear Creek

Geographic Description This corridor follows the alignment of Bear Creek from its junction with the Santa Ana River northward to the outlet of Big Bear Lake.

Resources Identified Bear Creek contains important riparian habitat, and is officially designated as a wild trout stream by the Department of Fish & Game. Bear Creek is also within the

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See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

inundation area of the dam at Big Bear Lake. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Open Space should be maintained along Bear Creek to preserve habitat values.

27. Spoor Canyon Wildlife Corridor

Geographic Description This corridor describes a general area which links the proposed Crafton Hills Open Space with the national forest.

Resources Identified This area contains a portion of Mill Creek, but is most important as an area to provide a connection between the national forest and Crafton Hills.

Open Space Objectives A wildlife dispersion corridor should be maintained within this corridor to provide continued opportunity for migration into and out of Crafton Hills.

28. Mountain Home Village/Creek Confluence

Geographic Description This area is located in the vicinity of Mountain Home Village, along the alignment of Mountain Home Creek. (Portions of Sections 4, 8, 9, R1W T1S).

Resources Identified This area contains one of the best examples of riparian forest in the San Bernardino mountains. The Creek also supports wild rainbow trout, and is therefore worthy of protection as a native fishery.

Open Space Objectives Habitat values--especially the riparian forest--should be maintained in this area.

29. Little San Gorgonio

Geographic Description This corridor follows the alignment of Little San Gorgonio Creek from the Riverside County line to the national forest. (Portions of Sections 1, 2, 10, 11, R1W T2S and Section 36, R1W T1N).

Resources Identified This area contains important riparian habitat, and is part of a proposed open space system which

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See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

includes Pisgah Peak. Substantial private ownership occurs throughout this corridor. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Open space should be maintained in this corridor to preserve habitat values and provide for wildlife dispersion. Cooperation should be sought with Riverside County to continue habitat protection in the portion of Little San Gorgonio Creek outside San Bernardino County.

30. Banning Canyon

Geographic Description This corridor follows the length of Banning Canyon from approximately Burnt Canyon to the national forest boundary. (Portions of Sections 2, 3, 4, 5, 7, 8, R1E T2S, and Sections 34, 35, 36, R1E T1S). This corridor ultimately connects with the South Fork of Whitewater River (Corridor 32).

Resources Identified This area contains population of bear, which use the canyon as a dispersion corridor. The canyon also contains riparian habitat. Substantial private ownership exists within the national forest.

Open Space Objectives Maintain habitat and dispersion values and consolidate national forest ownership.

31. Mill Creek

Geographic Description This corridor follows the alignment of Mill Creek from Forest Falls to its confluence with the Santa Ana River.

Resources Identified Mill Creek is an important riparian area, and supports wild rainbow trout (all fish-supporting streams in the County are rare and worthy of protection). Substantial private ownership exists within and outside the national forest. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Habitat values in Mill Creek should be maintained. If possible, public ownership should be consolidated.

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

32. South Fork Whitewater River

Geographic Description This corridor follows the alignment of the South Fork of the Whitewater River from approximately Raywood Flat to the national forest boundary (portions of Sections 31, 32, 33, 34, 35, 36, R2E T1S).

Resources Identified This area contains important riparian habitat, and supports native fish. This area also contains important habitat for Bighorn sheep. The Whitewater River supports a native fishery of rainbow trout which may be a relict population. The U.S. Forest Service is currently seeking to consolidate public/private ownership in this area.

Open Space Objectives Maintain habitat values; support efforts of Forest Service to consolidate public/private ownership.

33. North Fork Whitewater

Geographic Description This area follows the alignment of the North Fork of the Whitewater River within the national forest. (Portions of Sections 23, 24, 25, 26, R2E T1S).

Resources Identified This area contains critical Bighorn sheep habitat, as well as riparian areas. The Whitewater River supports a native fishery of rainbow trout which may be a relict population. Major private inholding on Section 25. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Maintain habitat values, especially for Bighorn sheep. Support efforts by Forest Service to consolidate public/private ownership.

34. Pacific Crest Trail

Geographic Description This area follows the alignment of the Pacific Crest Trail from the boundary of the national forest to the Riverside County line.

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

Resources Identified In addition to the trail, this area contains riparian and Bighorn sheep habitat.

Open Space Objectives Maintain habitat values and apply land use/design controls to limit visual impacts to areas visible from the Pacific Crest Trail.

35. Mission Springs

Geographic Description This area is located in the general vicinity of Mission Springs (generally around Section 35, R2E T1N).

Resources Identified This area contains Bighorn sheep and riparian habitat, and is traversed by the Pacific Crest Trail. The majority of Section 35 is in private ownership. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Maintain habitat values and apply land use/design controls to limit visual impacts to areas visible from the Pacific Crest Trail.

36. Pipes Canyon

Geographic Description This corridor is located along the alignment of Pipes Canyon in the national forest. (Portions of Sections 4, 5, 8, 9, 10, R3E T1N).

Resources Identified This corridor contains important wildlife and riparian habitat, in particular on the desert side of the mountains. All of Section 9 is in private ownership. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Maintain habitat values, seek public ownership of important habitat areas. Protect habitat outside national forest.

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

37. Sleepy Creek

Geographic Description This corridor follows the alignment of Sleepy Creek within the national forest. (Portions of Sections 32, 33, 34, R3E T2N).

Resources Identified Sleepy Creek contains important riparian habitat on the desert side of the mountains. The southern half of Section 33 is in private ownership. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Maintain habitat values, seek public ownership of important habitat areas. Protect habitat outside national forest.

38. Arrastre Creek

Geographic Description This area follows the alignment of Arrastre Creek from within the national forest (at approximately Section 2, R2E T2N) to the desert area (at approximately Section 6, R2E T3N).

Resources Identified This corridor contains important riparian habitat in a desert setting, and provides good habitat for birds. This creek is the only site in California at which the Hepatic Tanager is known to occur.

Open Space Objectives Maintain habitat values, seek public ownership of important habitat areas. Protect habitat outside national forest.

39. Grapevine Creek

Geographic Description This area follows the alignment of Grapevine Creek from Cactus Flat to the confluence with Arrastre Creek (portions of Sections 15, 16, 19, 20, 21 R2E T2N).

Resources Identified Grapevine Creek contains good riparian habitat of special value due to its proximity to the desert. Private ownership exists along the creek outside the national forest.

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

Open Space Objectives Maintain habitat values, seek public ownership of important habitat areas. Protect habitat outside national forest.

40. Rattlesnake Canyon

Geographic Description This corridor follows the alignment of Rattlesnake Canyon from the boundary of the national forest northward (portions of Sections 19, 20, 21, 27, 28, 29, 34, 35 R3E T3N, and Sections 2, 3, 10 R3E T2N).

Resources Identified This corridor contains important desert riparian habitat. The majority of the corridor is in public ownership.

Open Space Objectives Maintain habitat values, seek public ownership of important habitat areas.

41. Shay Meadow

Geographic Description This area is located east of Big Bear City and north of the Woodlands area.

Resources Identified Shay Meadow is an example of rare wet meadow habitat in the mountains, and supports a variety of endangered plants and animals, including stickleback fish. Substantial private ownership exists in this area. (See also the Open Space Element, the Biological Background Report, and the Big Bear Community Plan for further identification of potential biotic resources in this area.)

Open Space Objectives Maintain habitat values, seek public ownership of important habitat areas. Prevent development of adjacent areas which would adversely affect watershed. Protect stickleback and other species. Apply policies of Open Space Element and Big Bear Community Plan.

42. Big Bear Lake Watershed

Geographic Description This area includes the entire watershed of Big Bear Lake.

Resources Identified This area contains a number of specialized habitat areas, which support a large number of

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See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

endangered plants and animals (as well as commonly occurring mountain species). Substantial private ownership exists throughout this area, which is heavily urbanized adjacent to the lake. (See also the Open Space Element, the Biological Background Report, and the Big Bear Community Plan for further identification of potential biotic resources in this area.)

Open Space Objectives Maintain habitat values. Control development to prevent damage to important habitat areas. Apply policies of Open Space Element and Big Bear Community Plan.

43. Holcomb Valley

Geographic Description This area is located in the Holcomb Valley, which is part of the Big Bear Lake watershed area (see Area 42).

Resources Identified Holcomb Valley contains several examples of mountain habitats peculiar to this area, including pebble plains. These habitats support a variety of endangered species. Private ownership occurs in several areas. (See also the Open Space Element, the Biological Background Report, and the Big Bear Community Plan for further identification of potential biotic resources in this area.)

Open Space Objectives Maintain habitat values. Control development to prevent damage to important habitat areas. Apply policies of Open Space Element and Big Bear Community Plan.

44. Baldwin Lake

Geographic Description This area is located around Baldwin Lake, east of Big Bear Lake.

Resources Identified Baldwin Lake provides rare wet meadow habitat and supports a number of endangered species, including endangered stickleback fish. Private ownership occurs throughout this area. (See also the Open Space Element, the Biological Background Report, and the Big Bear Community Plan for further identification of potential biotic resources in this area.)

Open Space Objectives Maintain habitat values. Control development to prevent damage to important habitat areas. Apply policies of Open Space Element and Big Bear Community Plan.

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

45. Limestone Deposits

Geographic Description This encompasses an area of limestone deposits on the northern exposure of the San Bernardino Mountains, roughly from White Mountain to Blackhawk Mountain.

Resources Identified This area provides habitat for Bighorn sheep. The limestone deposits support plants peculiar to this area, including species being considered for federal protection as endangered species. Substantial private ownership occurs throughout this area. Mining of limestone currently taking place in several locations. Substantial private ownership exists in this area. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Maintain habitat values. Control development and mining to prevent damage to important habitat areas.

46. Dispersion Corridor

Geographic Description This area is located between the proposed Pisgah Peak area (see No. 47) and the boundary of the national forest. (Portions of Sections 25, 26, 27, 34, 35, 36, R1W T1S)

Resources Identified This area is important as an area to maintain wildlife dispersion between the Pisgah Peak area and the national forest. Substantial ownership exists in this area. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Maintain wildlife dispersion through this area.

47. Pisgah Peak

Geographic Description This area is centered around Pisgah Peak and includes portions of Sections 33, 34, 35, R1W T1S, and Sections 2, 3, 4, R1W T2S.

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

Resources Identified This area consists of a small, separate mountain range, and currently supports a diversity of wildlife species, including large mammals. Substantial private ownership exists, including lands within the boundaries of the national forest. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Maintain habitat values. Consolidate public/private ownership to reduce potential for destruction of habitat.

48. Chino Hills Open Space

Geographic Description This area generally includes a portion of the Chino Hills, including lands set aside as open space within private developments and by the state.

Resources Identified This area contains many examples of important habitat, and is a significant open space resource. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Maintain important habitat areas and connections with other nearby open space areas. Seek to make open space lands under County jurisdiction open to the public.

49. Dispersion Corridor

Geographic Description This describes a general area within which an open space corridor should be provided to link the Chino Hills area with other open space lands in the vicinity, including the Prado Dam inundation area.

Resources Identified This area is needed to allow continued dispersion of wildlife between these areas.

Open Space Objectives Maintain a wildlife dispersion corridor of sufficient size to allow continued wildlife dispersion.

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

50. California Institute for Men

Geographic Description This is the area within the California Institute for Men/California Youth Authority facilities in Chino.

Resources Identified This area is noted primarily as a reflection of the large amount of open land here which could become available for public use if the prison facility closes.

Open Space Objectives If the prison facility closes, support the retention of substantial open space in this area.

51. Chino Dairy Preserve

Geographic Description This is the area within the agricultural preserve established by the County Board of Supervisors, and includes the large Chino dairy operations.

Resources Identified This is an important farming area, and produces the majority of the agricultural goods produced in the County. As an agricultural area, the Dairy Preserve also has some potential for other open space uses (see the Open Space Element for a discussion of potential multiple uses of farmland).

Open Space Objectives The Board of Supervisors has extended agricultural protection in this area through 1997. See Soils/Agriculture Policy SA-2.q (referenced in the Open Space Element). No land acquisition is proposed in this area (other than by the Southern California Agricultural Land Foundation), except where no other means of protection is available.

52. Cajon Pass

Geographic Description This is the area generally within the Cajon Pass area, north of Devore to approximately Mormon Rocks.

Resources Identified The Cajon Pass area separates the Angeles and San Bernardino national forests, and is an area which animals must cross to travel between the forests. This area also contains important riparian habitat and natural areas. Substantial private ownership exists in this area. (See also the Open Space Element and the Biological Background Report for

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See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

further identification of potential biotic resources in this area.)

Open Space Objectives Maintain wildlife dispersion and habitat values in this area. Consolidate public/private ownership to prevent damage to important dispersion areas and habitat.

53. Santa Ana River

Geographic Description This includes the entire length of the Santa Ana River within San Bernardino County.

Resources Identified The Santa Ana River, although urbanized along some portions of its length, is one of the most important natural open space resources in the Valley and Mountain regions, providing important habitat and riparian areas. In its upper reaches, the river supports wild trout. Since the river passes through urban areas, it has the potential to serve as an important open space resource for human and wildlife use. Among the endangered species living on habitat in the river is the Santa Ana River woolystar, which is found only in this river. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Maintain the Santa Ana River as a natural open space area along its entire length. Improve habitat values where possible. Regulate sand and gravel operations within the river to prevent damage to habitat. Construct regional trail along the river. Cooperate with Riverside County, U.S. Forest Service, and adjacent cities to protect open space resources.

54. San Timoteo Canyon

Geographic Description This is the portion of San Timoteo Canyon within San Bernardino County, from the County line to its confluence with the Santa Ana River.

Resources Identified San Timoteo Canyon is largely undeveloped, and is an important open space resource both for natural habitat and scenic values. (See also the Open Space Element and the Biological Background Report for further

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

identification of potential biotic resources in this area.)

Open Space Objectives Maintain open space and scenic values along the canyon. Construct regional trail within the canyon. Cooperate with Riverside County and adjacent cities to protect open space resources.

55. Live Oak Canyon

Geographic Description This is the portion of Live Oak Canyon within San Bernardino County, from approximately the Crafton Hills to the County line.

Resources Identified The portion of Live Oak Canyon south of the I-10 freeway is largely undeveloped, and is an important open space resource both for natural habitat and scenic values. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Maintain open space and scenic values along the canyon. Construct regional trail within the canyon. Cooperate with Riverside County and adjacent cities to protect open space resources.

56. Crafton Hills Groves

Geographic Description This area generally describes an area of existing citrus operations west of the proposed Crafton Hills Open Space area.

Resources Identified This area is of value primarily as an agricultural district, although it also has scenic value as an example of the once-widespread citrus operations in the Valley region.

Open Space Objectives Maintain agricultural uses in this area. No land acquisition is proposed in this area, except where no other means of protection is available.

57. Crafton Hills Open Space

Geographic Description This is an area adjacent to Yucaipa Regional Park, generally described as the lands in the Crafton

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See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

Hills above an elevation of 2,400 feet.

Resources Identified This area is an important open space resource in the urbanizing Redlands/Yucaipa area, and has significant values as a relatively undisturbed habitat area, a scenic resource, and a potential area for recreational open space use. Substantial private ownership occurs in this area. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Maintain the Crafton Hills Open Space area in open space uses through purchase, transfer of density/development rights, or other means. See Open Space Policy in the Valley Region section of the General Plan.

58. Mojave River

Geographic Description This corridor follows the alignment of the Mojave River from Hesperia northward to past Barstow (See also No. 15.)

Resources Identified The Mojave River, which is the major perennial river in the desert region, is an area of extreme biologic importance, containing rare desert riparian habitat (including habitat capable of supporting the endangered Least bells vireo). (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives The entire length of the Mojave River should be maintained as open space to provide needed riparian habitat for desert species. Dispersion corridors should be provided along the river through urban areas.

59. Kelso Dunes Buffer Area

Geographic Description This is an area adjacent to the Kelso Dunes, extending several miles outward from the boundaries of the federally designated scenic area.

Resources Identified This area is identified primarily for its scenic values, although significant habitat also exists. (See also the Open Space Element and the Biological Background

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See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

Report for further identification of potential biotic resources in this area.)

Open Space Objectives Enforce scenic resource controls to preserve the appearance of this area and reduce visual impacts to the Kelso Dunes area. Restrict land uses which would destroy scenic or habitat values unless overriding considerations exist.

60. Buffer Area

Geographic Description This is an area adjacent to the Moabi Wildlife Preserve, extending several miles outward from the preserve boundaries.

Resources Identified This area is identified primarily for its scenic values, although significant habitat also exists. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Enforce land use controls to preserve the open space character of this area and reduce impacts to the wildlife reserve. Restrict land uses which would destroy scenic or habitat values.

61. Buffer area around Death Valley National Monument

Geographic Description This is an area adjacent to the portion of the Death Valley National Monument within San Bernardino County.

Resources Identified This area is identified primarily for its scenic values, although significant habitat also exists. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Enforce scenic resource controls to preserve the appearance of this area and reduce visual impacts to the national monument. Restrict land uses which would destroy scenic or habitat values.

62. Joshua Tree Monument Buffer

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

Geographic Description This is an area adjacent to the portion of the Joshua Tree National Monument within San Bernardino County.

Resources Identified This area is identified primarily for its scenic values, although significant habitat also exists. (See also the Open Space Element and the Biological Background Report for further identification of potential biotic resources in this area.)

Open Space Objectives Enforce scenic resource controls to preserve the appearance of this area and reduce visual impacts to the national monument. Restrict land uses which would destroy scenic or habitat values.

See Table D, at the end of this Background Appendix, for a detailed listing of approximate acreage within the areas listed, and approximate land acquisition costs. Not all areas listed are proposed for direct acquisition.

IV. COST ESTIMATES

To provide an estimate of costs for the proposed open space system, three separate items are noted: cost of land acquisition, cost of trail construction, and continuing operations and maintenance costs. These items are discussed separately below.

A. LAND ACQUISITION COSTS

Projected land acquisition costs for the regional open space system are shown in Table B, in the Addenda to this Background Appendix.

When dealing with a project such as the establishment of a regional open space system where exact areas to be acquired are not known, a determination of exact acquisition costs is difficult. The reader should note that the acquisition cost estimates provided in this report are rough, and subject to substantial refinement as determinations of specific parcels for purchase are made. Statements regarding the level of accuracy in the projected costs are provided in the preface to Table D.

B. TRAIL CONSTRUCTION COSTS

To determine trail construction costs, average per-mile costs for each type of trail were applied to the overall trail lengths shown in the Open Space Element. Average costs, based on the experience of open space agencies elsewhere in California and the United States, are as follows:

Paved Trail: Average cost of $50,000 to $80,000 per mile

Unpaved Trail (Equestrian Use, Hiking, Mountain Biking, Etc.): Average cost of $6,000 to $15,000 per mile.

These costs include the construction of directly related facilities which may be required for a given trail, including signage, parking lots, staging areas, bridges and stream crossings, landscaping, fencing, and comfort stations.

As with land acquisition costs, these cost estimates are by nature general, and will be subject to refinement as the preparation of detailed trail plans is completed.

Based on these general costs, estimated development costs for the proposed regional trails system are as shown in Table C. All costs assume that upper end of price range will apply; actual costs will fluctuate.

TABLE C
ESTIMATED TRAIL DEVELOPMENT COSTS[1]

Trail Name	Length (Miles)[1]	Cost/Mile	Total Cost
Rialto Trail	13.3	$80,000	$1,064,000
Baseline Road Trail	21.1	$80,000	$1,688,000
Cajon Creek Trail	20.3	$80,000	$304,500
Chino Hills Connector	4.7	$15,000	$70,500
City Creek Trail	5.6	$15,000	$84,000
Crafton Hills Trail	8.9	$15,000	$133,500
Cucamonga Creek Trail	29.8	$80,000	$2,384,000
Day Creek Trail	10.0	$80,000	$800,000
Deer Creek Trail	6.4	$80,000	$512,000
Demens Creek Trail			existing
Devils Canyon Connector	7.8	$15,000	$117,000
Edison/Schaefer Connector	10.4	$80,000	$832,000
Etiwanda Creek Connector	1.5	$15,000	
Frontline Trail	15.0	$15,000	$225,000
Frontline Connector	4.4	$15,000	$66,000

TABLE C (Cont'd)
ESTIMATED TRAIL DEVELOPMENT COSTS[1]

Trail Name	Length (Miles)[1]	Cost/ Mile	Total Cost
Greenbelt Trail	21.9	$15,000	$328,500
Jurupa Hills Trail	7.5	$15,000	$112,500
Live Oak Canyon Trail	5.8	$15,000	$87,000
L.A.D.W.P. Road Connector	3.5		existing rd.
Lytle Creek Trail	12.9	$15,000	$193,500
Mid-City Connector	7.3	$80,000	$584,000
Mill Creek Trail	13.5	$15,000	$202,500
Reche Canyon Trail	3.8	$15,000	$304,000
San Antonio Creek Trail	15.9	$80,000	$1,272,000
San Timoteo Creek Trail	8.9	$15,000	$133,500
Santa Ana River Trail	50	(Costs for this trail are not shown See detailed master plan for cost information.)	
		TOTAL:	$11,498,000

1. Costs do not include land acquisition, and do not reflect saving which might accrue if access roads, fire roads, or existing trail could be utilized as part of the regional system.

C. OPERATIONS AND MAINTENANCE

Operation and maintenance costs for the open space/trails portion of the regional open space system were determined based on the experience of the Midpeninsula Open Space District and the Marin County Open Space District. Both of these agencies indicated an average annual operating cost (in 1989) of $50 to $60 per acre of open space land managed.

This $50-60 figure includes:

- -- Maintenance of trails and other public facilities
- -- Operating costs
- -- Vehicle maintenance costs
- -- Salaries for paid staff.
- -- Capital outlays for minor projects (fence construction, minor repair items, etc.)

This figure does not include land acquisition costs, which are estimated in Table D. The average cost figure does reflect a substantial reliance on volunteer labor, primarily for trail and open space maintenance. (As noted in the Implementation section of this document, volunteerism will be essential to the success of the open space/trails system.)

Based on a preliminary estimated acquisition area of approximately 30,000 acres of land, and assuming that all lands will be managed by the County (some lands may not require intense management, or may be managed by other agencies, such as the U.S. Forest Service), total annual operating costs will be approximately $1,800,000.

This figure does not include operating costs for the regional park system; if regional park and open space operations are combined in one agency, some cost savings may result from the joint use of staff and equipment for parks and open space uses. The total operating cost for a joint regional park/open space district has not been calculated. In addition, since San Bernardino County is geographically larger than the open space districts surveyed, some costs may be higher due to increased travel times and the need to transport staff and equipment over large distances.

V. IMPLEMENTATION RECOMMENDATIONS

The following information expands on the implementation recommendations made in the Open Space Element.

A. IMPLEMENTATION MATRIX

To assist in the implementation process, the Implementation Matrix shown at the end of this Appendix was developed. The Matrix provides several categories of information:

-- An identification of various types of open space lands, including trails.

-- A listing of major categories of implementation strategies.

-- An assessment of the applicability of a given implementation strategy to each category of open space lands (and trails). In some cases, a strategy may be strongly suited to implementing a given category of open space lands; in others, the strategy may be applicable only in some situations. As shown in the Matrix, some strategies do not apply to all categories of open space lands.

-- An identification of the priority of each implementation strategy. Strategies are categorized into **Phase One**, which includes strategies which should be pursued as soon as possible following adoption of the Expanded Open Space Element; **Phase Two**, which includes strategies which are already part of the County's operating structure and which should be continued; and **Phase Three**, which includes strategies which will generally take place after land has been acquired and facilities (such as trails or staging areas) are being built or operated.

It is expressly intended that strategies from Phases One, Two, and Three may and should occur simulataneously. Implementation of strategies need not occur in Phase order.

Immediate, Continuing, and Operating strategies are discussed below. Additional information on implementation

strategies can be found in the informational reports included at the end of this Background Appendix.

B. PHASE ONE STRATEGIES

As discussed above, the following are strategies which should be implemented as soon as possible following adoption of the Open Space Element. In general, these strategies include items which will either take time to complete (and should therefore be started as soon as possible) and/or must be in place to allow other strategies to take place.

1. Seek Enaction of Special Open Space District Legislation

As part of the overall implementation of the proposed open space plan, it is recommended that the County immediately seek approval of state enabling legislation similar to that recently passed for the County of Riverside (Senate Bill 486). Briefly, this legislation (if approved in a form similar to SB 486) would provide the County with the ability to establish an open space district and a property assessment with a simple majority vote (50 percent of the voters plus one vote) rather than a two-thirds majority typically required to form a special district.

At the present time, introduction of this type of legislation for the County of San Bernardino is being pursued by the Regional Parks Department. Chances for its adoption cannot be accurately assessed at this time.

Some major features of the legislation approved by the legislature for Riverside County include the following:

-- The legislation takes into account a number of features in Riverside County which are very similar to those found in San Bernardino County, including the proximity of urban centers and rapidly expanding populations to open space lands and recreational opportunities, and provides special means for the County to address resultant open space needs.

-- The law provides that an Open Space District may be formed either independently by the Board of Supervisors

or upon receipt of a petition signed by 5,000 residents. After either passing a resolution independently or receiving a petition and holding a public hearing, the Board must schedule an election to form the Open Space District. A simple majority vote is required to form the District.

-- Either as part of the formation of the District, or in a subsequent election, a simple majority vote is required to establish a property assessment, which can be stated either as a flat fee, or as a range within which the assessment will fall.

-- The enabling legislation for Riverside County allowed the Open Space District to be empowered not only with the powers typically assigned to a District, but with all provisions of the Lighting and Landscaping Act of 1972 (discussed below).

The use of an SB 486-type District and assessment mechanism is one which is attractive, since it would make implementation more achievable while continuing to give voters the ability to approve or deny the District and assessment. Establishment of an Open Space/Trails District to provide funding to the proposed Regional Parks and Open Space Department would also provide a highly visible agency, giving the County's open space efforts a prestige which might not be result from the formation of, for instance, a County Service Area.

However, this strategy would require the adoption of a special state enabling act, which could be difficult--and which might not be achievable in the near future. In addition, this strategy would also require voter approval, even at a level lower than would be required for other non-CSA assessments. Therefore, this strategy may be considered as a first priority, holding other strategies in reserve or as supplements to an Open Space District.

2. Formation of a "Regional Parks and Open Space" District

This recommendation, which is similar to the Open Space District discussed above, would expand the purview of the District to cover both regional parks and open space/trails,

rather than open space/trails alone, as discussed above. This option has been examined by the Open Space Technical Committee of the County's Growth Management Task Force, which has recommended that it be pursued as the preferred option to implement a Countywide open space system.

To become realistically achievable, implementation of this option would still require the adoption of special enabling legislation similar to SB 486.

Since this Regional Parks and Open Space District would collect assessment revenues for both regional parks and open space, several changes in County government structure would be required, as discussed in Section V of this Conceptual Plan. In general, these would be related to the replacement of the existing Regional Parks Department with the Regional Parks and Open Space District.

3. Formation of a County Service Area

This strategy, although included as a Phase One recommendation, is intended for use only in the case the combined special legislation and parks/open space district discussed above are not successful. Formation of a County Service Area is viewed as a "fallback" strategy only, and should be pursued only if necessary.

Although used in San Bernardino County primarily to finance the construction of public infrastructure (such as water and sewer systems), facilities (such as fire stations), and some local park facilities, County Service Areas have the potential to provide funding for large, regional facilities such as the proposed open space/trails system.

Formation of a County Service Area, or of Improvement Zones within an existing CSA (such as CSA 70) has several advantages:

-- The Board of Supervisors may form a CSA without voter approval, provided that not more than 50 percent of the registered landowners within the proposed CSA protest its formation. A protest after the formation of a CSA from ten percent of the landowners within the area can

force an election on its formation (in which case a majority vote is required).

-- Once formed, the CSA has broad benefit assessment authority, and can impose property assessments without voter approval for a variety of uses, including the following, which could apply to open space/trails programs (a complete listing is included in Fieldman, Rolapp & Associates' appendix to the Preliminary Policies and Structure report prepared for the Open Space Element, which is included in this Background Appendix):

  -- Soil conservation and erosion control
  -- Geologic hazard abatement, including abatement on private property
  -- Local park, recreation, and parkway facilities and services.
  -- Any other governmental services which the County is authorized to perform and which the County does not perform to the same extent on a County-wide basis both within and outside of cities.

CSA's are empowered by state enabling legislation to finance "extended services" (including park and recreation facilities) through property assessment revenue, and additional "miscellaneous extended services" through the collection of charges or fees. (Assessments may also be collected for fire protection, although this has no impact on the ability of a CSA to collect fees for open space purposes.)

CSA's are not specifically empowered to issue bonds or other forms of debt, although these can be issued under other provisions of state law. Bonds can be issued by a CSA, for instance, subject to the same two-thirds voter approval requirement imposed on bonds. The CSA may also use a Certificate of Participation, using revenues to repay funds used to build capital facilities.

The establishment of a CSA would be a useful tool for the County. A CSA offers not only a number of financing and service advantages, but would also provide an omnibus entity to act in an administrative capacity.

However, a CSA would raise several issues with relation to the overall open space/trails effort. First, establishing a CSA would place the implementation of the open space/trails plan in the Office of Special Districts, rather than in a separate agency focused on open space and trails issues. This would both limit the visibility of the open space effort, potentially reducing public support, and would separate the planning function from regional parks and land management (although implementation of recommended cooperation strategies would reduce the effects of placing control in the Administrative Office).

Second, although a regular funding source would be established, the requirement that any bonded debt be approved by voters would limit the ability of the CSA to finance the immediate purchase of any large tracts of open space land, unless another financing arrangement could be implemented.

4. Work With Other Open Space Groups

This strategy, which should be begun immediately, involves a pro-active effort on the part of the County to seek out independent open space groups, such as the Save Our Forests Association, the Nature Conservancy, and other land conservancy groups, in order to coordinate planning, effort, and funding in support of open space preservation.

This strategy is shown as a Phase One strategy in part because of the support these groups can provide for both the enabling legislation and the voter approval for the open space/parks district.

5. Publicity

Publicity is included in the list of Phase One strategies to highlight the importance of building public support for the open space/parks district and to begin as soon as possible the process of informing the public of open space opportunities provided by the County and other cooperating agencies.

A method of keeping the media not only informed but involved is important. Features on the financing

opportunities in the press, and other media should be considered.

The production of the "marketing map" of proposed open spaces and trails which is to be completed after the adoption of the Open Space Element is the first action associated with this strategy.

6. Resource Banks

A Resource Bank would be used as part of an overall volunteerism strategy to maintain a listing of persons, corporations, and other sources of expertise, funding, materials, equipment, etc.. For instance, the Resource Bank could include a listing of all contractors who have expressed an interest in providing equipment and/or manpower to construct portions of the trails system, or of biologists who might donate time to identify habitat areas proposed for acquisition and preservation. This information could be extremely useful in activating a community and getting them involved in providing meaningful support for the County and its open space/trails needs.

7. Form A Non-Profit Corporation

A nonprofit corporation has many interesting use opportunities for the open space/trails system, and should be evaluated both as a vehicle to receive charitable gifts and as a meaningful part of an important asset management program. In addition, efforts can be coordinated with private nonprofit organizations (such as the Nature Conservancy) to either increase the ability to the County to provide open space lands and trails, or as a repository for some lands which are intended for permanent open space but which the County does not wish to retain.

Formation of a non-profit corporation is included as a Phase One strategy because this will facilitate other types of strategies.

C. PHASE TWO STRATEGIES

"Phase Two" includes a variety of ongoing implementation strategies, which are recommended to be applied to the implementation of the regional open space/trails system. These

strategies generally include practices which are part of the County's normal operations, or which should be begun and then continued throughout the lifetime of the open space system's acquisition, construction, and operation.

As with all strategies, some of the following may be best suited to individual projects, or to portions of the overall open space/trails system.

1. Cooperation with Local, State, and Federal Agencies

This strategy essentially involves cooperating with other governmental agencies in a variety of ways: coordinating planning, supporting policies and actions or other agencies which support the County's open space goals, and the like. This strategy is part of the County's current operations, but may be expanded to include open space issues or to place an increased emphasis in this area.

2. Density Transfer

This strategy, which is proposed in several policies in the Open Space Element, involves the use of density or "development right" transfers to preserve open space lands while allowing landowners to construct housing units or other developments allowed under existing zoning. This strategy is currently being used by the County in some situations.

3. Special Districts (Lighting and Landscaping, Mello-Roos)

This strategy involves the establishment of assessment districts to support the improvement and operation of some types of open space projects. As shown in the Implementation Matrix, this type of strategy is best applied to specific projects which provide a demonstrable "benefit" to a clearly defined area.

4. Policy Implementation

This strategy involves the implementation of policies in the Open Space Element and elsewhere in the General Plan.

5. Grants/Aid Programs

This strategy involves a directed search for grants and aid programs which could provide funding for portions of the open space and trails systems. A careful review of available grants should be completed, including not just public sources, but private foundations as well. Unusual combinations of sources should also be identified, such as historic preservation and the State Arts Commission and private foundations. Grants for construction of handicapped-accessible facilities, for instance, may be available, as might funds for the acquisition of permanent open space for habitat preservation.

6. Fee Structure

This strategy, which is best suited to recreational open space, is currently being used by Regional Parks. Essentially, this strategy involves charging fees for admission to some recreation amenities; the fees are used to offset or partially subsidize operating expenses. As shown in the Implementation Matrix, this strategy could be applied to portions of the trail system (as an example, the County of San Diego currently charges an annual permit fee for equestrian users).

7. Land Use Regulation

This strategy involves the designation of land uses (and the application of appropriate policies) which support the County's open space goals.

8. Cooperation With Cities

Although part of the interagency cooperative strategy listed earlier, this is highlighted as a separate strategy due to the high level of cooperation which will be necessary to establish the open space system in the Valley region.

D. PHASE THREE STRATEGIES

As noted earlier, Phase Three strategies generally apply to the long-term operation of the open space/trails system, or require that some portions of the system be in place.

1. Public/Private Joint Venture

In some cases, opportunities may exist to establish a relationship with the private sector which can generate income for the Open Space/Trails District or contribute needed equipment or services. For instance, private construction companies may donate labor to construct trails, trailheads, or some attractions at recreationally oriented facilities.

A strategy should be pursued to establish special relationships with private corporations to secure additional support for specific programs, facilities or projects. This effort should play to the strength of the corporation and provide it with the type of exposure and experience that directly benefits them (examples might include recognition of the corporation or private venture partner through tastefully done advertising or other on-site or published information).

2. Individual Contributions

A strategy which should not be overlooked is the potential for soliciting individual contributions of land or money. Central to this strategy is the creation of a clearly identifiable "open space" agency which would receive these gifts, and the creation of a non-profit corporation to provide tax benefits to the donor.

3. Donated Labor and Materials

This strategy is similar to the acceptance of donated land and money, but involves the use of donated labor or materials for the construction or operation of facilities. This strategy, as shown in the Implementation Matrix, this strategy best applies to smaller projects which can be constructed with volunteer (often eager but unskilled) labor, such as trailheads, portions of the trail system in low-use areas, and the like. Construction of major facilities, such as large buildings in recreational areas, is generally not suited to the use of donated labor.

4. Gift Books

"Gift Books" would be used to list needed items at a range of price levels, with the intent to encourage donations to the Regional Parks and Open Space Department or its nonprofit counterpoint. For instance, the Gift Book could list prices for a linear distance of hiking trail, for a picnic table in a staging area, or for large and small amounts of open space lands. The gift book idea gives people the opportunity to give things to an organization that the organization needs. Major private universities usually use this device to the greatest extent.

If used in the County's situation, it would be helpful to provide the Open Space/Trails District with a permanent staff member responsible for pursuing funding sources. The printing and distribution of the gift needs catalog could be secured through private contributions.

5. "Adopt-A-Trail" or "Adopt-An-Open-Space"

This program gives a group, a person, or an organization the opportunity to take some ownership for a facility and see to it that it receives the care, the funding, and the equipment it needs to be a positive and important recreation and park resource in the community. Equestrian groups, for instance, could volunteer to provide some maintenance or patrol services on portions of the trails system; recognition of the group providing the support would be placed at the site to build a sense of pride and ownership among the volunteers.

As shown in the Implementation Matrix, this strategy is best applied to recreational areas and trails which are clearly identifiable and may be informally "adopted" whether or not a specific program is in place.

6. General Fundraising

This strategy involves the use of general fundraising techniques to solicit donations to support the open space/trails system. A variety of techniques, which should be selected and coordinated by the County's open space coordinator, could be used.

7. Special Fundraising

This is similar to "general fundraising," but would involve solicitations for a specific open space project, such as the acquisition of a particular piece of land or the construction of a clearly identified portion of a trail system. In this case, donations would be sought for a specific purpose, rather than for general "open space" use.

8. Direct Purchase of Open Space Lands

This strategy involves the direct purchase of open space lands by the County in order to preserve open space values. As shown, this strategy is proposed for most categories of open space land, but is not considered to be suited for the preservation of lands retained to preserve the managed production of resources (with the exception of farmed agricultural land).

To reduce costs, this strategy should be relied upon only after less costly strategies, such as land use regulation, density transfers, etc., are tried.

9. Corporate Sponsors

This strategy is similar to public/private joint ventures, and involves the use of ongoing sponsorship for the construction and operation of portions of the open space system. As shown in the Matrix, this strategy applies best to trails and high-use recreational areas, where the corporate sponsor can be provided with maximum visibility. The use of on-site or published advertising or exposure for the corporate sponsor will be important to the success of this strategy.

10. Asset Management

All existing County property which is acquired for open space purposes should be evaluated to determine if there is a way to generate income from assets that is in addition to the normal recreation or open space use for the asset. Use of some lands for income-generating purposes could raise funds which could be used elsewhere in the open space/trails system. This would necessitate a broad

definition of the Regional Parks and Open Space Department's mission or charter in its formation documents.

VI. BIBLIOGRAPHY/CONTACTS

The following is an expanded listing of information sources noted in the Open Space Element, as well as a bibliography of information which may be consulted by planners and the public for more detailed information on open space issues.

A. INFORMATION SOURCES

1. General Information Sources

California State Endangered Species Act

County of Kern. Scenic Highways: An Element of the Kern County General Plan. 1974.

Department of the Interior, Bureau of Land Management. The California Desert Conservation Area Plan. 1980.

East Bay Regional Park District. 1988. Master Plan. Parkland Planning Department.

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WESTEC Services. San Bernardino County Biological Resources Background Report. San Bernardino County Office of Planning, March 1989.

2. Wildlife/Natural Resources References

The following are excellent sources of general information regarding natural resources, corridor design, and habitat areas.

Adams, Lowell W., and Louise E. Dove. Wildlife Reserve and Corridors in the Urban Environment. Washington, D.C.: U.S. Department of the Interior, Fish and Wildlife Service, 1989.

Hammitt, W.E. and D.N. Cole. 1987. Wildland Recreation; Ecology and Management. New York: Wiley and Sons, 341 pp.

"Lee County, Florida, Protects Wildlife." Zoning News, November 1989.

Leedy, Daniel L., et al. Planning for Wildlife in Cities and Suburbs. Chicago, Il: American Society of Planning Officials, 1978.

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Soule', Michael E., Ed. Conservation Biology: The Science of Scarcity and Diversity. Massachusetts: Sinauer Associates, Inc., 1986.

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Preserving Communities and Corridors. Washington, D.C.: Defenders of Wildlife, 1989.

Tourbier, J. Toby, and Richard Westmacott. "Looking Good: The Use of Natural Methods to Control Urban Runoff." Urban Land, April 1989, pp 32-35.

3. Agricultural Preservation

The following sources may be consulted for information regarding agricultural issues and preservation.

American Farmland Trust. Eroding Choices, Emerging Issues: The Condition of California's Agricultural Land Resources (Executive Summary). San Francisco, CA.

American Farmland Trust. Planning and Zoning for Farmland Protection: A Community Based Approach. American Farmland Trust, January 1987.

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4. Preservation Techniques

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5. Trail Planning

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Association of Bay Area Governments (ABAG). 1989. Draft Bay Trail Plan.

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San Bernardino County. Proposed Master Plan For Equestrian and Hiking Trails.Department of Parks and Recreation. 1975.

San Francisco Bay Ridge Trail. 1989. Draft Management Guide.

United States Department of Agriculture, Forest Service. Standard Specifications for Construction of Trails. June 1984.

B. INFORMATION CONTACTS

The following is a selected listing of primary persons and organizations who may be contacted for information regarding open space issues. Many additional sources may also be consulted, but are not listed here.

Bureau of Land Management
Barstow Resource Area
150 Coolwater Lane
Barstow, CA 92311

Bureau of Land Management
Needles Resource Area
Box 888
Needles, CA 92363

Bureau of Land Management
California Desert District
1695 Spruce Street
Riverside, CA 92507

California Department of Fish and Game
330 Golden Shore, Suite 50
Long Beach, CA 90802
(213) 590-5113

California Department of Conservation
1416 Ninth Street
Sacramento, CA 95814
(916) 324-2555

California Department of Conservation
Farmland Mapping Program
1516 Ninth Street, Rm 400
Sacramento, CA 95814
(916) 324-0868
Contact: Emily Kishi, Planner

California Department of Food and Agriculture
1220 N Street, Room 104
Sacramento, CA 95814
(916) 322-5227

California Department of Forestry
1416 N Street, Room 1516-2
Sacramento, CA 95814

California Department of Parks and Recreation (Land and Water Conservation Fund)
Planning and Local Assistance Division
P.O. Box 2390
Sacramento, CA 95811
(916) 322-9576
Contact: Ross Henry

California Department of

Transportation
(Trails Issues)
P.O. Box 942874
Sacramento, CA 94274
(916) 322-9015
Contact: Richard Blunden

Defenders of Wildlife
1244 Nineteenth Street NW
Washington, DC 20036

Marin County
Open Space District
Marin County Civic Center
San Rafael, CA 94903
(415) 499-6387

Rails-To-Trails
Conservancy
1400 16th Street NW
Washington, DC 20036
(202) 797-5400
Contact: John Wengert

San Bernardino National
Forest
P.O. Box 7
26577 Hwy 18
Rimforest, CA 92378
(714) 337-2444

Solano County
Environmental Management
601 Texas Street
Fairfield, CA 94533
(707) 429-6561
Contact: Harry
Englebright,
Senior Planner

State Coastal Conservancy
1330 Broadway, Suite 1100
Oakland, CA 94612
(415) 464-1015
Contact: Peter Grenell,
Executive Officer

U.S. Department of Agriculture
Soil Conservation Service
(714) 792-3762

TABLE D: WILDLIFE CORRIDOR/POLICY AREA ACREAGES AND ACQUISITION ESTIMATES

The information in the table on the following pages indicates (except where noted) the land area within each of the wildlife corridors and policy areas shown on the Open Space Map of the Resources Overlay. To illustrate some opportunities and constraints related to implementation, this table also contains a breakdown of jurisdictional control within each area, and an estimate of the area in private ownership (and therefore potentially subject to purchase, acceptance for dedication, etc.).

When using this information, several factors should be recognized:

Acreage Figures Are General To compute the acreage figures in Table D, the total area within a corridor or policy area was measured. However, wildlife corridors will in most cases occupy only a portion of the area identified on the Open Space Map. To correct for this, it has been assumed in most cases that direct acquisition of only one-quarter to one-third of private lands in a corridor or area would be necessary. Actual acquisition could vary from this assumption.

Cost Estimates Reflect Purchase As A Primary Strategy Table D estimates the approximate costs which would result from direct purchase of private lands in identified areas. However, other, less costly strategies, such as regulatory control, may achieve preservation of identified areas at substantially reduced costs. Purchase of development rights only (with title remaining privately owned) could also reduce costs in some areas. The estimated acquisition costs shown in Table D should therefore be used as a "worst case" analysis; actual funding requirements may be much reduced.

Lands Outside Identified Areas Are Not Shown Table D provides a breakdown of identified areas. However, acquisition may be used as a preservation strategy for other lands not specifically identified on the Open Space Map. These individual acquisition projects cannot be foreseen, and would increase the total acquisition costs shown in Table D.

Land Costs Are Approximate Land costs shown in Table D are approximate, and are based on recent sales or asking prices in the general vicinity of identified wildlife corridors and policy areas. No determination has been made of exact parcels of land which may be acquired, making more detailed estimates impossible. Special factors affecting particular parcels which may be subject to acquisition cannot be determined at this time, and are not reflected in Table D.

TABLE B: ACQUISITION COST ESTIMATES

NO.	POLICY AREA/ WILDLIFE CORRIDOR	PRIMARY PURPOSE	? GROSS ACREAGE	ACREAGE WITHIN COUNTY	INCORPORATED AREA	AREA UNDER FEDERAL CONTROL	AREA UNDER STATE CONTROL	PRIVATELY OWNED LAND	COST PER 1 ACRE	COST PER 10-30 ACRES	COST PER 100+ ACRES	POTENTIAL ACRES TO BE ACQUIRED	TOTAL ACQUISITION (RANGE) LOW	TOTAL ACQUISITION (RANGE) HIGH
1	Day Canyon	Riparian/wildlife protection	1,400	500		900		500	$90,000	$50,000	$20,000	166.5	$3,330,000	$14,985,000
2	East Etiwanda Creek	Riparian/wildlife protection	400	150		250		150	$90,000	$50,000	$20,000	49.95	$999,000	$4,495,500
3	Lytle Creek	Riparian/wildlife protection	1,581	517		1,064		517	$50,000	$30,000	$20,000	172.161	$3,443,220	$8,608,050
4	Middle Fork Lytle Creek	Riparian/wildlife protection	858	44		602		256	$50,000	$30,000	$20,000	85.248	$1,704,960	$4,262,400
5	North Fork Lytle Creek	Riparian/wildlife protection	1,666	146		1,520		146	$50,000	$30,000	$20,000	48.618	$972,360	$2,430,900
6	South Fork Lytle Creek	Riparian/wildlife protection	596	69		527		69	$50,000	$30,000	$20,000	22.977	$459,540	$1,148,850
7	Lone Pine Canyon	Riparian protection in southern portion. USFS and USFWS manage for deer habitat.	3,467	1,024		2,443		1,024	$50,000	$30,000	$20,000	340.992	$6,819,840	$17,049,600
8	Cajon Wash	Native fishery and riparian vegetation in Cajon Creek. Habitat for Least bells vireo and endangered plants	3,148	754	2,394			3,148	$40,000	$25,000	$4,000	787	$3,148,000	$31,480,000
9	Cleghorn Canyon	Dispersion corridor across I-15 Fwy. Most important large mammal corridor between national forests.	900	181		719		181	$40,000	$25,000	$4,000	60.273	$241,092	$2,410,920
10	Crowder Canyon	Riparian habitat; potential habitat for Least bells vireo	630	185		445		185	$40,000	$25,000	$4,000	61.605	$246,420	$2,464,200
11	Cajon Wash Tributary	Wildlife habitat on private inholdings.	384	80		304		80	$40,000	$25,000	$4,000	26.64	$106,560	$1,065,600

TABLE D: ACQUISITION COST ESTIMATES

NO.	POLICY AREA/ WILDLIFE CORRIDOR	PRIMARY PURPOSE	GROSS ACREAGE	ACREAGE WITHIN COUNTY	INCORPORATED AREA	AREA UNDER FEDERAL CONTROL	AREA UNDER STATE CONTROL	PRIVATELY OWNED LAND	COST PER 1 ACRE	COST PER 10-30 ACRES	COST PER 100+ ACRES	POTENTIAL ACRES TO BE ACQUIRED	TOTAL ACQUISITION (RANGE) LOW	TOTAL ACQUISITION (RANGE) HIGH
12	Little Horsethief Canyon	Riparian habitat.	2,706	1,307		953		1,253	$50,000	$30,000	$10,000	417.249	$4,172,490	$20,862,450
13	Mojave River Headwaters	Riparian habitat; important area for deer.	348			178	170	0	$50,000	$30,000	$10,000	0	$0	$0
14	Lake Silverwood	Eagle perching area. (No acquisition)	3,855			2,091	1,764	0	$50,000	$30,000	$10,000	N/A	N/A	N/A
15	Mojave River	Riparian habitat; habitat for Least bells vireo.	3,815	1,558		2,257		1,558	$70,000	$40,000	$10,000	389.5	$3,895,000	$27,265,000
16	Grass Valley Creek	Riparian habitat; potential Least bells vireo habitat. Native fish. Important dispersion corridor.	2,737	536		2,201		536	$30,000	$20,000	$5,000	178.488	$892,440	$5,354,640
17	Deep Creek Tributry and Mojave River	Riparian habitat; potential Least bells vireo habitat. Native fish. Important dispersion corridor.	1,252			1,252		0	$40,000	$25,000	$5,000	0	$0	$0
18	Spotted Owl Habitat Area	Good habitat for this species in canyons.	6,688	2,797		3,891		2,797	$100,000	$20,000	$20,000	699.25	$13,985,000	$69,925,000
19	Waterman Canyon	Riparian area. Good habitat for deer.	1,750	778	859	113		1,637	$50,000	$20,000	$20,000	409.25	$8,185,000	$20,462,500
20	Strawberry Creek	Riparian habitat.	3,367	1,111		2,256		1,111	$50,000	$26,000	$20,000	369.963	$7,399,260	$18,498,150
21	Lake Arrowhead	Eagle perching area. (No acquisition)	N/A					0	N/A	N/A	N/A	N/A	N/A	N/A
22	Dispersion Corridor	Only undeveloped portion of "Rim" area between desert and coastal side of mountains.	8,737	2,519		6,218		2,519	$120,000	$35,000	N/A	838.827	$29,358,945	$100,659,240

TABLE 8: ACQUISITION COST ESTIMATES

NO.	POLICY AREA/ WILDLIFE CORRIDOR	PRIMARY PURPOSE	GROSS ACREAGE	ACREAGE WITHIN COUNTY	INCORPORATED AREA	AREA UNDER FEDERAL CONTROL	AREA UNDER STATE CONTROL	PRIVATELY OWNED LAND	COST PER 1 ACRE	COST PER 10-30 ACRES	COST PER 100+ ACRES	POTENTIAL ACRES TO BE ACQUIRED	TOTAL ACQUISITION (RANGE) LOW	TOTAL ACQUISITION (RANGE) HIGH
23	Deep Creek	Good riparian habitat	5,562	1,032		4,530		1,032	$120,000	$35,000	$5,000	343.656	$12,027,960	$41,230,770
24	City Creek	Riparian habitat and link to Santa Ana River. Native fish and trout. Santa Ana River woolystar sighted.	1,983	225	445	1,313		670	$120,000	$35,000	$5,000	223.11	$7,808,850	$26,773,200
25	Plunge Creek	Riparian area and link to Santa Ana River. Native fish.	873	95	483	295		578	$120,000	$35,000	$5,000	192.474	$6,736,590	$23,096,880
26	Bear Creek	Riparian habitat. Designated trout stream.	1,603	12		1,591		12	$120,000	$35,000	$5,000	3.996	$139,860	$479,520
27	Crafton Hills Link	Area to connect Crafton Hills with national forest.	809	667	142			809	$150,000	$40,000	$8,000	202.25	$1,618,000	$30,337,500
28	Mountain Home Village/Creek Confluence	One of the best riparian forests in the local mountains.	866					346	$40,000	$10,000	$3,000	115.3512	$1,153,512	$4,614,048
29	Little San Gorgonio	Riparian habitat	918	832		86		832	$40,000	$10,000	$3,000	277.056	$831,168	$11,082,240
30	Banning Canyon	Good riparian habitat. Used by bears as dispersion area.	2,900	2,450	450			2,900	$40,000	$10,000	$3,000	965.7	$2,897,100	$38,628,000
31	Mill Creek	Riparian area with native fish.	3,832	1,635		1,197		2,635	$40,000	$10,000	$3,000	877.455	$2,632,365	$35,098,200
32	South Fork Whitewater River	Riparian habitat with native fish. Bighorn sheep area.	1,928	964		964		964	$40,000	$10,000	$3,000	321.012	$963,036	$12,840,480
33	North Fork Whitewater River.	Critical Bighorn sheep area. Riparian habitat with native fish.	3,250	700		1,550		1,700	$40,000	$10,000	$3,000	566.1	$1,698,300	$22,644,000

TABLE B: ACQUISITION COST ESTIMATES

NO.	POLICY AREA/ WILDLIFE CORRIDOR	PRIMARY PURPOSE	GROSS ACREAGE	ACREAGE WITHIN COUNTY	INCORPORATED AREA	AREA UNDER FEDERAL CONTROL	AREA UNDER STATE CONTROL	PRIVATELY OWNED LAND	COST PER 1 ACRE	COST PER 10-30 ACRES	COST PER 100+ ACRES	POTENTIAL ACRES TO BE ACQUIRED	TOTAL ACQUISITION (RANGE) LOW	TOTAL ACQUISITION (RANGE) HIGH
34	Pacific Crest Trail	Bighorn sheep habitat and riparian area. Visual impact to Pacific Crest Trail.	1,442	964		478		964	$40,000	$10,000	$3,000	321.012	$963,036	$12,840,480
35	Mission Springs	Bighorn sheep habitat and riparian area. Visual impact to Pacific Crest Trail.	1,161	307	128	631		530	$40,000	$10,000	$3,000	176.49	$529,470	$7,059,600
36	Pipes Canyon	Wildlife and riparian habitat (especially on desert side).	1,330	665		665		665	$40,000	$10,000	$3,000	221.445	$664,335	$8,857,800
37	Sleepy Creek	Riparian habitat on desert side.	1,010	505		505		505	$40,000	$10,000	$3,000	168.165	$504,495	$6,726,600
38	Arrastre Creek	Riparian habitat on desert side.	2,826	125		2,701		125	$40,000	$10,000	$3,000	41.625	$124,875	$1,665,000
39	Grapevine Creek	Good riparian habitat.	2,345			2,345		0	$40,000	$10,000	$3,000	0	$0	$0
40	Rattlesnake Canyon	Riparian habitat in desert setting.	2,923	95		2,828		95	$40,000	$10,000	$3,000	31.635	$94,905	$1,265,400
41	Shay Meadow	Wet meadow habitat supports endangered plants. Habitat for endangered stickleback fish.	549			549		0	$150,000	$40,000	$3,000	0	$0	$0
42	Big Bear Lake Watershed	Important habitat area for many species. (No acquisition)	19,775	7,517	915	4,505	6,830	8,432	N/A	N/A	N/A	N/A	N/A	N/A
43	Holcomb Valley	Important mountain habitat area.	6,304	540		5,764		540	$150,000	$40,000	$3,000	135	$405,000	$20,250,000
44	Baldwin Lake	Habitat for sensitive species. Habitat for endangered stickleback fish when water												

TABLE 8: ACQUISITION COST ESTIMATES

NO.	POLICY AREA/ WILDLIFE CORRIDOR	PRIMARY PURPOSE	GROSS ACREAGE	ACREAGE WITHIN COUNTY	INCORPORATED AREA	AREA UNDER FEDERAL CONTROL	AREA UNDER STATE CONTROL	PRIVATELY OWNED LAND	COST PER 1 ACRE	COST PER 10-30 ACRES	COST PER 100+ ACRES	POTENTIAL ACRES TO BE ACQUIRED	TOTAL ACQUISITION (RANGE) LOW	TOTAL ACQUISITION (RANGE) HIGH
		is available.	2,986		1,493	2,308		678	$150,000	$40,000	$3,000	169.5	$508,500	$25,425,000
45	Limestone Deposits	Limestone area provides habitat for bighorn sheep and plants endemic to area.	28,917	8,316		20,474	127	8,316	$150,000	$20,000	$2,000	2079	$4,158,000	$311,850,000
46	Dispersion Corridor	Connection between Pisgah Peak and national forest.	1,103					1,103	$150,000	$10,000	$8,000	367.299	$2,938,392	$55,094,850
47	Pisgah Peak	Wildlife habitat in area of scattered national forest inholdings.	3,793	2,058		1,735		2,058	$150,000	$40,000	$10,000	685.314	$6,853,140	$102,797,100
48	Chino Hills Open Space	Area within Chino Hills Specific Plan required to provided as open space. (No acquisition)	N/A					0	N/A	N/A	N/A	N/A	N/A	N/A
49	Dispersion Corridor	Connection between Chino Hills open space area, Prado Dam inundation area, open lands within California Institute for Men, and Chino Dairy Preserve.	7,388	639	6,749			7,388	$175,000	$80,000	N/A	2460.204	$196,816,320	$430,535,700
50	California Institute for Men	Prison facility contains substantial open areas; potential for retention as open land if prison closes. (No acquisition)	N/A					0	N/A	N/A	N/A	N/A	N/A	N/A
51	Chino Dairy Preserve	Important dairy area; currently in agricultural preserve. (No acquisition)	N/A					0	N/A	N/A	N/A	N/A	N/A	N/A

TABLE B: ACQUISITION COST ESTIMATES

NO.	POLICY AREA/ WILDLIFE CORRIDOR	PRIMARY PURPOSE	GROSS ACREAGE	ACREAGE WITHIN COUNTY	INCORPORATED AREA	AREA UNDER FEDERAL CONTROL	AREA UNDER STATE CONTROL	PRIVATELY OWNED LAND	COST PER 1 ACRE	COST PER 10-30 ACRES	COST PER 100+ ACRES	POTENTIAL ACRES TO BE ACQUIRED	TOTAL ACQUISITION (RANGE) LOW	TOTAL ACQUISITION (RANGE) HIGH
52	Cajon Pass	Large mammal dispersion area. Riparian and natural areas.	15,716	7,864	7,170	682		15,034	$50,000	$30,000	$20,000	5006.322	$100,126,440	$250,316,100
53	Santa Ana River	Important connection between national forest and Pacific Ocean.	20,731	6,958	5,532	8,241		12,490	$50,000	$30,000	$20,000	4159.17	$83,183,400	$207,958,500
54	San Timoteo Canyon	Natural area with creek provides wildlife habitat and dispersion.	3,549	1,489	2,060			3,549	$150,000	$40,000	$15,000	1181.817	$17,727,255	$177,272,550
55	Live Oak Canyon	Natural area with creek provides wildlife habitat and dispersion.	2,224	2,224				2,224	$150,000	$40,000	$15,000	740.592	$11,108,880	$111,088,800
56	(Not Assigned)													
57	Crafton Hills Groves	Area proposed for retention of agricultural uses. (No acquisition)	3,938	3,232	706			3,938	N/A	N/A	N/A	N/A	N/A	N/A
58	Crafton Hills Open Space	Open lands in Crafton Hills	4,052	3,670	357	25		4,027	$150,000	$40,000	$15,000	3020.25	$45,303,750	$453,037,500
59	Desert Urban Area Buffer	Area proposed for land use controls to control city sprawl in desert. (No acquisition)	N/A					0	N/A	N/A	N/A	N/A	N/A	N/A
60	Barstow Buffer	Area proposed for land use controls. (No acquisition)	N/A					0	N/A	N/A	N/A	N/A	N/A	N/A
61	Mojave River	Important riparian area in desert. See Nos. 13 and 15.	N/A					0	$50,000	$3,000	$2,000	N/A	N/A	N/A

TABLE B: ACQUISITION COST ESTIMATES

NO.	POLICY AREA/ WILDLIFE CORRIDOR	PRIMARY PURPOSE	GROSS ACREAGE	ACREAGE WITHIN COUNTY	INCORPORATED AREA	AREA UNDER FEDERAL CONTROL	AREA UNDER STATE CONTROL	PRIVATELY OWNED LAND	COST PER 1 ACRE	COST PER 10-30 ACRES	COST PER 100+ ACRES	POTENTIAL ACRES TO BE ACQUIRED	TOTAL ACQUISITION (RANGE) LOW	TOTAL ACQUISITION (RANGE) HIGH
62	Kelso Dunes Buffer Area	Area for land use controls to protect Kelso dunes. (No acquisition)	N/A					0	N/A	N/A	N/A	N/A	N/A	N/A
63	Buffer Area	Area for land use controls to protect wildlife reserve. (No acquisition)	N/A					0	N/A	N/A	N/A	N/A	N/A	N/A
64	Death Valley Buffer Area	Area for land use controls adjacent to Death Valley National Monument (No acquisition)	N/A					0	N/A	N/A	N/A	N/A	N/A	N/A
65	Joshua Tree Mon. Buffer Area	Area for land use controls adjacent to Joshua Tree National Monument (No acquisition)	N/A					0	N/A	N/A	N/A	N/A	N/A	N/A
	TOTALS:	//////////////////////	208,379	70,031	29,803	96,154	8,899	102,806				30177.49	$599,876,861	$2,784,301,768

NO.	POLICY AREA/	PRIMARY	GROSS	ACREAGE	INCOR-	AREA UNDER	AREA UNDER	PRIVATELY	COST PER	COST PER	COST PER	ACRES	LOW	HIGH

SOILS/AGRICULTURE

SOIL AND AGRICULTURE

I. INTRODUCTION

Soil formation is the result of the weathering of bedrock in the presence of abiotic and biotic factors through time. These factors--temperature, wind, water, plants and animals--combine to form soils with specific characteristics that vary from one area to another. Soil resources are soil types that are beneficial to man. These provide substrate for plant growth, water cleansing, and structural support for construction. Soil characteristics can be constraints as well as assets. Soil characteristics that can limit land uses are high shrink-swell potential, high acidity or alkalinity, high water content, high proportions of sand, or rock and shallow soil depth.

These soil types are prone to erosion, landsliding, liquefaction, subsidence and reactivity problems that are discussed in the Geologic, non-seismic, hazards section. The soils that provide agricultural potential are discussed here.

San Bernardino County is situated within the most topographically diverse state in the nation. It is divided into three major physiographic provinces, the inland valley, the transverse ranges, and the desert region. Each of these provinces can be further subdivided into smaller regions that vary in geology, topography, and climate and consequently in soil characteristics.

II. CURRENT STATUS/ANALYSIS

A. Sources of Data

Most of the area within the county has not been surveyed in detail. The San Bernardino Valley (see Figure 1, Tables 1 & 2) and the Mojave River Area (see Figure 2, Tables 3 & 4) have had soil surveys published and these maps are on file with the Office of Planning. The remaining areas of the desert and the mountain region have not had detailed surveys. The soils of the mountain region have been characterized (see Figure 3, Table 5) in the Forest Land and Resource Management Plan, also on file with the Office of Planning.

The agricultural potential of the state has been inventoried and represented on maps produced by the California Department of Conservation in the Important Farmland Map series (on file with the Office of Planning). These maps show areas of agricultural potential based upon the physical characteristics of the soil. Areas of Prime Farmland and Farmland of Statewide Importance are required by the California Environmental Quality Act (CEQA) to be reviewed for significant adverse effect when projects are proposed that would affect their productivity.

Data sources used for this investigation include:

California Department of Food and Agriculture (CDFA). 1981. Important Farmlands Inventory as Applied to the State of California, February.

County of San Bernardino, 1979. Consolidated General Plan, as amended through 1986.

County of San Bernardino, 1987. Annual Crop and Livestock Report.

U.S. Bureau of Land Management (BLM), 1980. The California Desert Conservation Area Plan.

U.S. Forest Service, 1988. San Bernardino National Forest Land and Resource Management Plan.

U.S. Soil Conservation Service (SCS), 1986. Soil Survey of San Bernardino County, Mojave River Area, February.

U.S. Soil Conservation Service (SCS), 1980. Soil Survey of San Bernardino County, Southwestern Part, January.

B. Existing Conditions

Soils

The County of San Bernardino contains thousands of acres which are considered potentially valuable for agricultural uses on the basis of physical soil characteristics. The primary means utilized to designate valuable soils is the Important Farmlands Inventory.

The Important Farmlands Inventory designates three separate agricultural categories on the basis of soil properties: Prime Farmland, Additional Farmland of State-wide Importance, and Unique Farmland. These classifications were adapted for California Agriculture by the State Department of Food and Agriculture in 1981. The resultant changes in definition were minor, consisting of additional specifications regarding available water capacity and minimum rooting depth (CDFA 1981).

Prime Farmland includes areas best suited (and available) for producing food, feed, forage, fiber and oilseed crops. It has the soil quality, growing season, and moisture supply necessary to economically produce sustained high yields when treated and managed (including water management) according to modern farming methods (CDFA 1981). The CDFA definition for Prime Farmland includes detailed specifications related to soil moisture regimes, temperature, pH, groundwater levels, conductivity, sodium ion

exchange, flooding potential, erodibility, permeability, texture, and rooting depth.

Farmland of Statewide Importance includes available areas (other than Prime Farmland) which exhibit a good combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops (CDFA 1981). The CDFA definition of Farmland of Statewide Importance include similar (although less stringent) criteria as described above for Prime Farmland, with the exception of rooting depth which is not included as a requirement.

Unique Farmland consists of areas (other than Prime Farmland or Additional Farmland of Statewide Importance) that is currently used for the production of specific high-value food and fiber crops. Unique Farmlands possess appropriate combinations of soil quality, location, growing season, and moisture supply necessary to produce sustained high quality and/or high yields of specific crops when treated and managed according to modern farming methods. These crops are generally of high economic importance to California as determined in the annual report of the CDFA, and include commodities such as citrus, avocadoes, olives, tree nuts, grapes, grains, vegetables, strawberries, and cut flowers (CDFA 1981).

A number of areas throughout the County meet the above agricultural criteria for designation as Valuable or Important farm lands. Following are discussions on the known and potential locations of these soil classes by geographic area.

Valley

The Valley region contains a number of soils which meet the criteria for valuable agricultural soils based on the three important soil groups described above. The greatest concentrations of these soils are in the vicinity of the cities of Chino and Ontario, and in the east Valley area. Site-specific mapping of Important Farmland designations has not been conducted for the Valley region, although adequate data exists (SCS 1980) to conduct such mapping.

In addition to the Important Farmlands described above, the Valley region likely contains moderate acreages of undeveloped areas suitable for use as urban agricultural or pasture lands. Soils in the Valley region consist predominantly of deep, well drained loams and sandy loams which are amenable to agricultural use. Portions of nine separate soil associations are located within the Valley region, with six of these (comprising approximately 80 percent of the Valley area) possessing physical and chemical characteristics suitable for agricultural production (SCS 1980). It should be noted, however, that much of the Valley region currently supports urban development and is not available

for agricultural use. Projected continuation of urban growth in the Valley region will serve to exacerbate this situation.

Mountain

Little information is available regarding specific soil characteristics in the Mountains region. It is anticipated that Important Farmlands are also mostly absent from the Mountains region, due to the general nature of soils there. Most areas of the mountains are expected to exhibit generally shallow, coarse soils with excessive drainage, and steep slopes. Possible exceptions to this include more level terrain in the vicinity of major storage reservoirs.

Desert

Information on the occurrence of Important Farmlands in the Desert region is limited to the Mojave River area, which includes approximately 1,200,000 acres along the Mojave River Basin and major tributaries between Silverwood Lake and the town of Baker. Over 300,000 acres (nearly 26 percent) of this total is likely to be Prime Farmland under the State of California definition (see above). Additional large acreages of Unique Farmland and Farmland of Statewide Importance are also located in the Mojave River area (SCS 1986).

Agriculture

Agriculture was a leading industry in 1987, with an assessed product value in excess of $550 million (County of San Bernardino 1987). Over 93,000 acres (including incorporated areas) are currently under cultivation throughout the County for a variety of uses, including livestock and dairy farming, citrus, fruits and vegetables, and speciality crops.

Agricultural use within the county has declined in recent years, primarily due to the effects of urban expansion and economic considerations. Most agricultural development is located in areas with relatively level terrain and stable soil conditions. For similar reasons, these types of areas are also the most desirable (and economically valuable) for urban development. As urban expansion encroaches into agricultural areas, remaining agricultural developments are often surrounded by urban activities. This situation exacerbates the further conversion of agricultural land due to the presence of urban services extensions (sewer, water, etc.), the associated increase in potential land values for urban uses (which often exceeds the agricultural dollar value), and the increased incidence of land use incompatibility. In addition, a number of agricultural areas within the county have been converted to other uses due to declining viability, decreasing air quality, and increasing water costs.

As farmers relocate, agricultural uses often change to more specialized and high unit value crops which can be grown in less desirable (from the standpoint of urban development) terrain. The net result of the above situation is that the amount of vacant land which can be converted to most agricultural uses is steadily diminishing.

Valley

The Valley region contains considerable agricultural development, predominantly in the vicinity of the cities of Chino and Ontario, and in the east Valley. This includes substantial dairy farming (in the south Chino area), citrus groves (in the east Valley), and a multitude of other crops.

Approximately 36,000 acres of agricultural land are located in 22 separate agricultural preserves in the Valley, of which over 26,000 acres are under the jurisdiction of the Williamson Act. The Williamson Act (California Land conservation Act, California Administrative Code 51200, et seq.) allows lands in agricultural use to be placed under contract (agricultural preserve) between a land owner and a land regulating agency, with certain provisions. The owner must agree not to develop to property for 10 years, in exchange for property tax reductions based on the property's value as open space or agricultural, rather than as developable land. The contract automatically renews each year for a new 10-year period unless the owner states his intention, by filing a "Notice of Non-renewal" (Government Code Section 51245-49), to terminate the contract at the end of the current 10-year period. During the 10-year cancellation period, property taxes are gradually raised so that at the end of the 10 years, the taxes are at the current rate for developable land. Of the total area currently under Williamson Act contracts, over 12,000 acres are classified as Prime Farmlands.

The phenomenon of urban expansion described above is particularly applicable to the Valley region, where the bulk of the County population currently resides. Much of the existing urban development in the Valley is located in areas formerly utilized for agricultural purposes (e.g., extensive citrus groves).

Mountain

As described above under the Soils heading, much of the Mountain region is likely not amenable to agricultural development. Little information is available regarding current agricultural development in the Mountains, although it is assumed that existing agricultural activities are limited primarily to range and pasture uses.

Desert

Agricultural development in the Desert region is limited primarily to the Mojave River area as described above under the Soils heading. This area produces significant dollar values in field crops, poultry, and livestock.

The Desert region has great potential for agricultural development. Substantial acreages of Important and Farmlands are located there, particularly in the Mojave Desert area. Much of the Desert region is not subject to the pressures of urban development described for the Valley region, and is likely more suited to long-term agricultural use. This is due to both the large expanses of potentially arable land and the relatively small localized zones of projected urban growth located there. Agricultural potential in the Desert region, if realized, could provide a suitable replacement for agricultural areas likely to be lost in the Valley from the anticipated continuation of urban expansion. Extensive agricultural growth in the Desert may be limited, however, by the lack of local water supplies and/or the inaccessibility of imported water. Imported water currently cannot be supplied to many desert areas which are potentially suitable for agricultural use, due to the lack of adequate conveyance facilities and/or allocation rights.

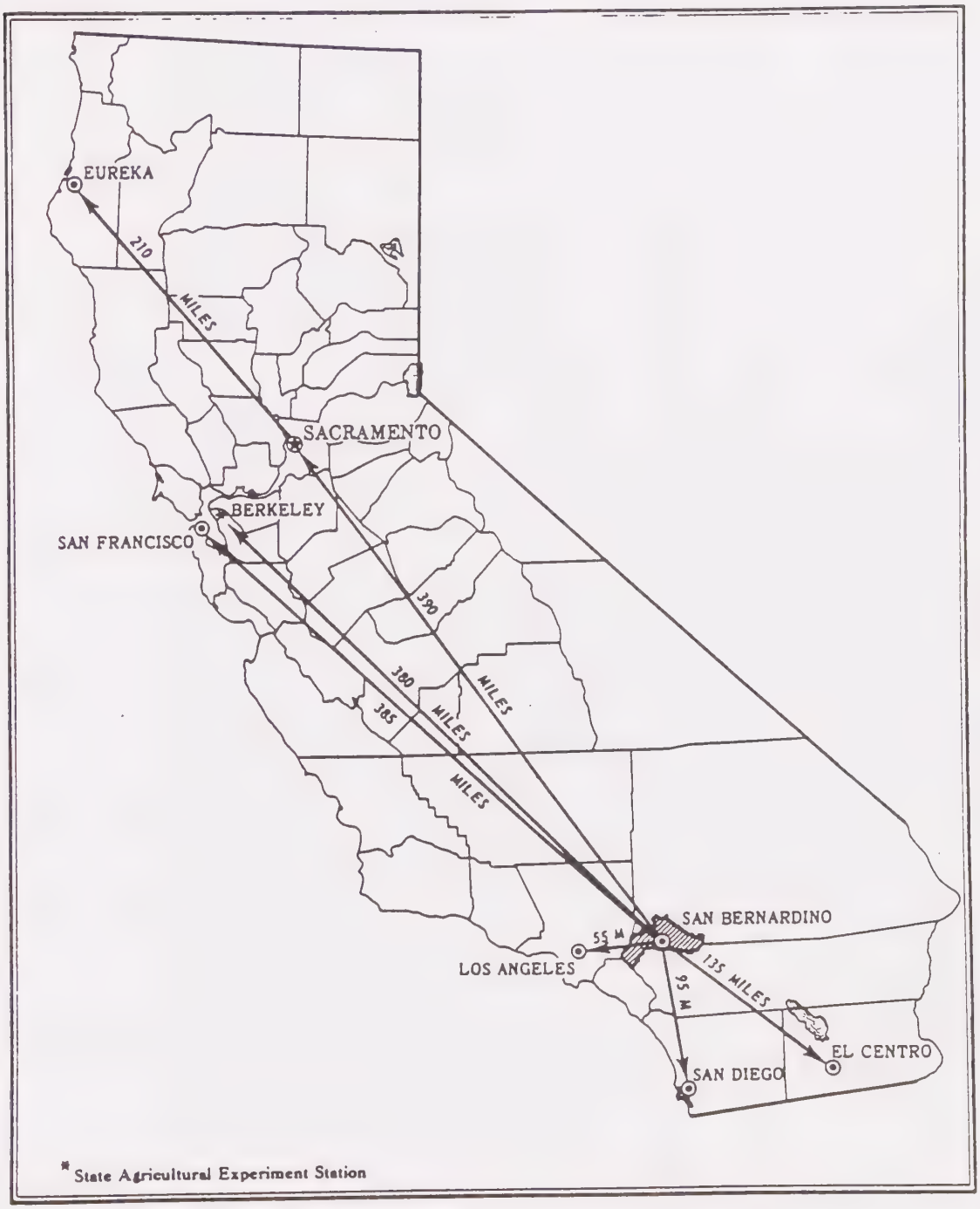


Figure 1. Location of San Bernardino County, Southwestern Part, in California.

TABLE 1.—*Soil series classified according to the current system of classification*
[Classification as of July 1972]

Series	Family	Subgroup	Order
Alo	Fine, montmorillonitic, thermic	Typic Chromoxererts	Vertisols.
Chino[1]	Fine-loamy, mixed, thermic	Aquic Haploxerolls	Mollisols.
Chualar	Fine-loamy, mixed, thermic	Typic Argixerolls	Mollisols.
Cieneba	Loamy, mixed, nonacid, thermic, shallow	Typic Xerorthents	Entisols.
Crafton	Coarse-loamy, mixed, mesic	Entic Haploxerolls	Mollisols.
Delhi	Mixed, thermic	Typic Xeropsamments	Entisols.
Fontana	Fine-loamy, mixed, thermic	Calcic Haploxerolls	Mollisols.
Friant	Loamy, mixed, thermic	Lithic Haploxerolls	Mollisols.
Garretson	Fine-loamy, mixed, nonacid, thermic	Typic Xerothents	Entisols.
Gaviota	Loamy, mixed, nonacid, thermic	Lithic Xerorthents	Entisols.
Grangeville	Coarse-loamy, mixed, thermic	Fluvaquentic Haploxerolls	Mollisols.
Greenfield	Coarse-loamy, mixed, thermic	Typic Haploxeralfs	Alfisols.
Hanford	Coarse-loamy, mixed, nonacid, thermic	Typic Xerorthents	Entisols.
Hilmar	Sandy over loamy, mixed (calcareous), thermic	Aeric Halaquepts	Inceptisols.
Merrill	Fine-silty, mixed, thermic	Aquic Calcixerolls	Mollisols.
Metz	Sandy, mixed, thermic	Typic Xerofluvents	Entisols.
Monserate	Fine-loamy, mixed, thermic	Typic Durixeralfs	Alfisols.
Nacimiento	Fine-loamy, mixed, thermic	Calcic Haploxerolls	Mollisols.
Oak Glen	Coarse-loamy, mixed, mesic	Pachic Haploxerolls	Mollisols.
Ramona	Fine-loamy, mixed, thermic	Typic Haploxeralfs	Alfisols.
San Emigdio	Coarse-loamy, mixed (calcareous), thermic	Typic Xerofluvents	Entisols.
San Timoteo	Coarse-loamy, mixed (calcareous), thermic	Typic Xerorthents	Entisols.
Saugus	Coarse-loamy, mixed, nonacid, thermic	Typic Xerorthents	Entisols.
Soboba	Sandy-skeletal, mixed, thermic	Typic Xerorthents	Entisols.
Soper	Fine-loamy, mixed, thermic	Typic Argixerolls	Mollisols.
Sorrento[1]	Fine-loamy, mixed, thermic	Calcic Haploxerolls	Mollisols.
Tollhouse	Loamy, mixed, mesic, shallow	Entic Haploxerolls	Mollisols.
Tujunga	Mixed, thermic	Typic Xeropsamments	Entisols.
Vista	Coarse-loamy, mixed, thermic	Typic Xerocherpts	Inceptisols.

[1] In San Bernardino County, Southwestern Part, the following soils are taxadjuncts to the series for which they are named:

Chino soils tend to have bright, distinct mottles higher in the profile than is within the defined range for the Chino series.

Sorrento soils lack segregated lime at a depth of less than 40 inches, which is not within the defined range for the Sorrento series. These differences do not alter the usefulness or behavior of these soils.

TABLE 2.— *Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Alo clay, 30 to 50 percent slopes	1,080	0.4
Chino silt loam	6,630	2.2
Chualar clay loam, 0 to 2 percent slopes	905	.3
Chualar clay loam, 2 to 9 percent slopes	2,645	.9
Chualar clay loam, 9 to 15 percent slopes	1,055	.4
Cieneba sandy loam, 9 to 15 percent slopes	545	.2
Cieneba-Friant sandy loams	1,060	.4
Cieneba-Rock outcrop complex	14,790	5.0
Crafton-Rock outcrop complex, eroded	550	.2
Delhi fine sand	20,440	6.9
Fontana clay loam, 15 to 30 percent slopes	1,755	.6
Fontana clay loam, 30 to 50 percent slopes	6,800	2.3
Friant-Rock outcrop complex	2,270	.8
Garretson very fine sandy loam, 2 to 9 percent slopes	500	.2
Gaviota-Rock outcrop complex	4,720	1.6
Grangeville fine sandy loam	7,510	2.5
Grangeville fine sandy loam, saline-alkali	1,350	.5
Greenfield sandy loam, 2 to 9 percent slopes	8,010	2.7
Greenfield sandy loam, 9 to 15 percent slopes	525	.2
Greenfield cobbly sandy loam, 5 to 15 percent slopes	220	(1)
Hanford coarse sandy loam, 2 to 9 percent slopes	27,655	9.3
Hanford coarse sandy loam, 9 to 15 percent slopes	1,655	.6
Hanford sandy loam, 0 to 2 percent slopes	6,615	2.2
Hilmar loamy fine sand	4,135	1.4
Merrill silt loam	1,155	.4
Metz coarse sandy loam, 2 to 9 percent slopes	300	.1
Monserate sandy loam, 2 to 9 percent slopes	640	.2
Nacimiento clay loam, 9 to 30 percent slopes	1,270	.4
Nacimiento clay loam, 30 to 50 percent slopes	3,030	1.0
Oak Glen sandy loam, 2 to 9 percent slopes	540	.2
Oak Glen gravelly sandy loam, 9 to 15 percent slopes	1,060	.4
Oak Glen gravelly sandy loam, 15 to 30 percent slopes	670	.2
Psamments and Fluvents, frequently flooded	8,800	3.0
Ramona sandy loam, 2 to 9 percent slopes	8,040	2.7
Ramona sandy loam, 9 to 15 percent slopes	3,310	1.1
Ramona sandy loam, 15 to 30 percent slopes, eroded	3,180	1.1
San Emigdio sandy loam, 9 to 15 percent slopes	370	.1
San Emigdio gravelly sandy loam, 2 to 9 percent slopes	470	.2
San Emigdio fine sandy loam, 0 to 2 percent slopes	1,900	.6
San Emigdio fine sandy loam, 2 to 9 percent slopes	3,145	1.1
San Timoteo loam, 30 to 50 percent slopes, eroded	2,430	.8
Saugus sandy loam, 30 to 50 percent slopes	9,455	3.2
Soboba gravelly loamy sand, 0 to 9 percent slopes	11,740	3.9
Soboba stony loamy sand, 2 to 9 percent slopes	23,225	7.8
Soper gravelly loam, 15 to 30 percent slopes	380	.1
Soper gravelly loam, 30 to 50 percent slopes	550	.2
Sorrento clay loam, 0 to 2 percent slopes	1,680	.6
Sorrento clay loam, 2 to 5 percent slopes	305	.1
Tollhouse sandy loam, 30 to 50 percent slopes	4,460	1.5
Tujunga loamy sand, 0 to 5 percent slopes	42,930	14.4
Tujunga gravelly loamy sand, 0 to 9 percent slopes	36,720	12.3
Vista-Rock outcrop complex	1,020	.3
Quarries and gravel pits	685	.2
Total	296,880	100.0

[1] Less than 0.1 percent.



Figure 2. — Location of San Bernardino County, California, Mojave River Area.

TABLE 3.—CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Arizo	Sandy-skeletal, mixed, thermic Typic Torriorthents
Arrastre	Coarse-loamy, mixed, mesic Typic Xerochrepts
Avawatz	Sandy, mixed, mesic Mollic Xerofluvents
Bousic	Fine, mixed (calcareous), thermic Typic Torriorthents
Bryman	Fine-loamy, mixed, thermic Typic Haplargids
Bull Trail*	Fine-loamy, mixed, mesic Mollic Haploxeralfs
Cajon**	Mixed, thermic Typic Torripsamments
Calciorthids	Calciorthids
Cave	Loamy, mixed, thermic, shallow Typic Paleorthids
Crafton	Coarse-loamy, mixed, mesic Entic Haploxerolls
Cuddeback	Fine-loamy, mixed, thermic Typic Durargids
Cushenbury	Coarse-loamy, mixed, mesic Typic Haploxerolls
Fluvents	Fluvents
Glendale Variant	Fine-silty, mixed, (calcareous), thermic Typic Torrifluvents
Halloran	Coarse-loamy, mixed, thermic Typic Natrargids
Haplargids	Haplargids
Haploxeralfs	Haploxeralfs
Hanford	Coarse-loamy, mixed, nonacid, thermic Typic Xerorthents
Helendale	Coarse-loamy, mixed, thermic Typic Haplargids
Hesperia	Coarse-loamy, mixed, nonacid, thermic Xeric Torriorthents
Joshua	Fine-loamy, mixed, thermic Haplic Durargids
Kimberlina	Coarse-loamy, mixed (calcareous), thermic Typic Torriorthents
Lavic	Coarse-loamy, mixed, thermic Typic Calciorthids
Lithic Torriorthents	Lithic Torriorthents
Lovelace	Sandy, mixed, thermic Typic Calciorthids
Lucerne	Coarse-loamy, mixed, thermic Xeralfic Haplargids
Manet	Sandy, mixed, thermic Typic Torrifluvents
Mirage	Fine-loamy, mixed, thermic Typic Haplargids
Mohave Variant	Fine-loamy, mixed, thermic Typic Haplargids
Nebona	Loamy, mixed, thermic, shallow Typic Durorthids
Norob	Fine-loamy, mixed, thermic Typic Natrargids
Oak Glen	Coarse-loamy, mixed, mesic Pachic Haploxerolls
Peterman	Fine, mixed, thermic Typic Calciorthids
Rosamond	Fine-loamy, mixed (calcareous), thermic Typic Torrifluvents
Sheephead	Loamy, mixed, mesic, shallow Entic Ultic Haploxerolls
Soboba	Sandy-skeletal, mixed, thermic Typic Xerofluvents
Sparkhule	Loamy, mixed, thermic Lithic Haplargids
Torriorthents	Torriorthents
Torripsamments	Torripsamments
Trigger	Loamy, mixed (calcareous), thermic Lithic Torriorthents
Tujunga	Mixed, thermic Typic Xeropsamments
Typic Haplargids	Typic Haplargids
Typic Xerorthents	Typic Xerorthents
Victorville	Coarse-loamy, mixed (calcareous), thermic Typic Torrifluvents
Victorville Variant	Coarse-loamy, mixed (calcareous), thermic Typic Torrifluvents
Villa	Sandy, mixed, thermic Typic Torrifluvents
Wasco	Coarse-loamy, mixed, nonacid, thermic Typic Torriorthents
Wrightwood	Coarse-loamy, mixed, mesic Typic Haploxeralfs
Yermo	Loamy-skeletal, mixed (calcareous), thermic Typic Torriorthents

* The Bull Trail soil in this survey area is taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

** The Cajon soil in map unit 116 is taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Soil name	Acres	Percent
Arizo gravelly loamy sand, 2 to 9 percent slopes	9,500	0.8
Arrastre-Rock outcrop complex, 30 to 50 percent slopes	12,100	1.1
Avawatz-Oak Glen association, gently sloping	12,000	1.0
Badland	3,500	0.3
Bousic clay	7,500	0.6
Bryman loamy fine sand, 0 to 2 percent slopes	38,000	3.2
Bryman loamy fine sand, 2 to 5 percent slopes	25,700	2.1
Bryman loamy fine sand, 5 to 9 percent slopes	8,000	0.7
Bryman loamy fine sand, 9 to 15 percent slopes	3,000	0.3
Bryman sandy clay loam, 0 to 2 percent slopes	500	*
Bryman-Cajon association, rolling	7,500	0.6
Bull Trail-Typic Xerorthents association, moderately steep	8,800	0.7
Cajon sand, 0 to 2 percent slopes	46,200	3.9
Cajon sand, 2 to 9 percent slopes	117,200	9.8
Cajon sand, 9 to 15 percent slopes	6,600	0.6
Cajon gravelly sand, 2 to 15 percent slopes	59,400	5.0
Cajon loamy sand, 5 to 9 percent slopes	8,600	0.7
Cajon loamy sand, loamy substratum, 0 to 2 percent slopes	28,800	2.4
Cajon-Arizo complex, 2 to 15 percent slopes	66,000	5.5
Cajon-Wasco, cool, complex, 2 to 9 percent slopes	5,900	0.5
Cave loam, dry, 0 to 2 percent slopes	4,100	0.3
Crafton-Sheephead-Rock outcrop association, steep	7,000	0.6
Cushenbury-Crafton-Rock outcrop complex, 15 to 50 percent slopes	12,900	1.1
Dune land	6,200	0.5
Fluvents, occasionally flooded	1,100	0.1
Glendale Variant silt loam, saline-alkali	2,300	0.2
Gullied land-Haploxeralfs association	19,900	1.7
Halloran sandy loam	21,200	1.8
Halloran-Dune land complex, 0 to 15 percent slopes	2,900	0.2
Hanford sandy loam, cool, 2 to 9 percent slopes	800	*
Haplargids-Calciorthids complex, 15 to 50 percent slopes	4,100	0.3
Helendale loamy sand, 0 to 2 percent slopes	9,200	0.8
Helendale loamy sand, 2 to 5 percent slopes	16,600	1.4
Helendale-Bryman loamy sands, 2 to 5 percent slopes	43,500	3.6
Hesperia loamy fine sand, 2 to 5 percent slopes	19,200	1.6
Joshua loam, 2 to 5 percent slopes	14,200	1.2
Joshua loam, 9 to 15 percent slopes	4,700	0.4
Kimberlina loamy fine sand, cool, 0 to 2 percent slopes	17,800	1.5
Kimberlina loamy fine sand, cool, 2 to 5 percent slopes	3,000	0.3
Kimberlina gravelly sandy loam, cool, 2 to 5 percent slopes	5,400	0.5
Lavic loamy fine sand	5,500	0.5
Lovelace loamy sand, 5 to 9 percent slopes	4,500	0.4
Lucerne sandy loam, 0 to 2 percent slopes	4,800	0.4
Lucerne sandy loam, 2 to 5 percent slopes	6,400	0.5
Manet coarse sand, 2 to 5 percent slopes	29,200	2.4
Manet cobbly coarse sand, 2 to 9 percent slopes	2,400	0.2
Manet loamy sand, loamy substratum, 0 to 2 percent slopes	9,300	0.8
Manet fine sandy loam, 0 to 2 percent slopes	1,800	0.2
Mirage sandy loam, 2 to 5 percent slopes	22,000	1.8
Mirage-Joshua complex, 2 to 5 percent slopes	44,000	3.7
Mohave Variant loamy sand, 0 to 2 percent slopes	2,200	0.2
Nebona-Cuddeback complex, 2 to 9 percent slopes	32,300	2.7
Norob-Halloran complex, 0 to 5 percent slopes	41,800	3.5
Peterman loam	300	*
Peterman clay	1,900	0.2
Pits	1,500	0.1
Playas	19,500	1.6
Riverwash	11,600	1.0
Rock outcrop-Lithic Torriorthents complex, 15 to 50 percent slopes	112,700	9.4
Rosamond loam, saline-alkali	9,200	0.8
Rosamond loam, strongly saline-alkali	600	*
Soboba gravelly sand, cool, 2 to 9 percent slopes	1,300	0.1
Sparkhule-Rock outcrop complex, 15 to 50 percent slopes	43,400	3.6
Torriorthents-Torripsamments-Urban land complex, 0 to 9 percent slopes	1,900	0.2
Trigger gravelly loam, 5 to 15 percent slopes	7,200	0.6
Trigger-Sparkhule-Rock outcrop association, steep	2,800	0.2
Trigger-Rock outcrop complex, 30 to 50 percent slopes	5,200	0.4
Tujunga sand, cool, 2 to 9 percent slopes	1,600	0.1
Typic Haplargids-Yermo complex, 8 to 30 percent slopes	7,500	0.6
Victorville sandy loam	6,300	0.5

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Soil name	Acres	Percent
Victorville Variant sand	2,600	0.2
Villa loamy sand	13,700	1.1
Villa loamy sand, hummocky	3,000	0.3
Wasco sandy loam, cool, 0 to 2 percent slopes	16,000	1.3
Wasco sandy loam, cool, 2 to 5 percent slopes	4,100	0.3
Wrightwood-Bull Trail association, sloping	7,300	0.6
Yermo gravelly sandy loam, 30 to 50 percent slopes	2,600	0.2
Yermo-Kimberlina, cool, association, sloping	18,200	1.5
Water	900	*
Total	1,200,000	100.0

* Less than 0.1 percent.

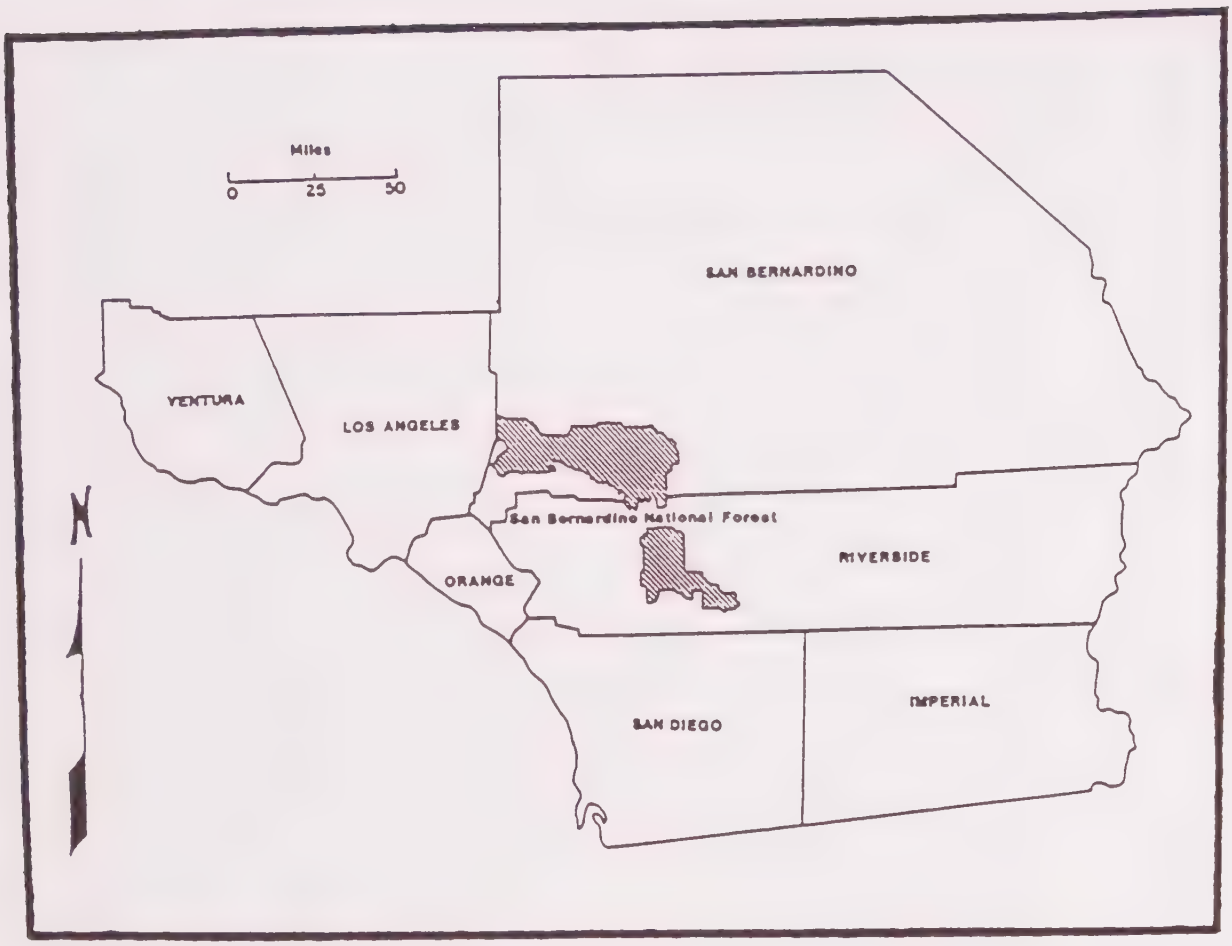


Figure 3. Location of the San Bernardino National Forest

Table 5.

SOILS

Forestwide Productivity Groups

Productivity Group	Soil Name	Acres	% of Forest
HIGH	Morical family, very deep	19,420	2.4
	Ruch family	8,200	1.0
		27,620	3.4
MODERATE	Cagey family	1,770	0.2
	Corbett family	3,140	0.4
	Green Bluff family	2,040	0.2
	Hanford family	4,670	0.6
	Hecker family	8,150	1.0
	Hodgson family	1,850	0.2
	Kilburn family	2,470	0.3
	Modesto family	13,415	1.6
	Morical family	20,690	2.5
	Oak Glen family	9,045	1.1
	Ramona family	2,730	0.3
	San Andreas family	2,135	0.3
	Switchback family	3,130	0.4
	Typic Haploxeralfs	6,920	0.8
		82,155	9.9
LOW	Brader family	4,525	0.5
	Goulding family	16,040	2.0
	Lizzant family	3,155	0.4
	Merkel family	8,230	1.0
	Oak Glen family, dry	7,335	1.0
	Olete family	31,235	3.8
	Pacifico family	47,060	5.7
	Preston family	13,650	1.7
	Springdale family	12,965	1.6
	Tollhouse family	1,620	0.2
	Tyee family	1,190	0.1
	Typic Xerorthents, warm	8,090	1.0
	Wapal family	18,140	2.2
	Wapi family	20,655	2.5
	Wind River family	15,810	1.9
	Winthrop family	4,150	0.5
		213,850	26.1

Productivity Group	Soil Name	Acres	% of Forest
VERY LOW	Avawatz family	6,585	0.8
	Lithic Xerorthents	36,355	4.4
	Lithic Xerorthents, calcareous	10,925	1.3
	Lithic Xerorthents, cool	18,275	2.2
	Lithic Xerorthents, dry	15,350	1.9
	Lithic Xerorthents, warm	55,815	6.8
	Morical family, dry	9,145	1.1
	Osito family	14,720	1.8
	Pacifico family, dry	27,645	3.4
	Soboba family	8,845	1.1
	Springdale family, dry	22,665	2.8
	Trigo family	70,465	8.6
	Typic Xerorthents	6,400	0.8
	Wapi family, dry	34,070	4.2
	Wilshire family	7,040	0.9
	Wrightwood family	5,910	0.7
		350,210	42.8
MISCELLANEOUS AREAS			
Badland		8,025	1.0
Riverwash		7,365	0.9
Rock outcrop		102,395	12.5
Rubbleland		20,990	2.6
Water		6,390	0.8
		145,165	17.8

MINERALS

MINERAL RESOURCES

I. INTRODUCTION

It is the growth, development and needs of society that makes mineral resources important to our life. When we order a new car, fly away to a vacation spot for relaxation, or build a new house, we've all put in an order for more minerals and mining. As the population's numbers and activities grow, our need for resources also grows. In San Bernardino County, these factors have significantly intensified over the last several years and will continue to intensify for the foreseeable future. This need for San Bernardino County, Southern California and the nation is cause to comprehensively evaluate all mineral resources for their existing and future requirements for development.

Mineral resources compose a major sub-issue within the Natural Resources of the General Plan. Issues that are examined are mine planning, environmental effects, reclamation, public health and welfare, slope stability, erosion, resoiling, revegetation, adequacy of a Reclamation Plan, Identification, Classification, and Designation of resources.

A. Definitions

Mineral Extraction

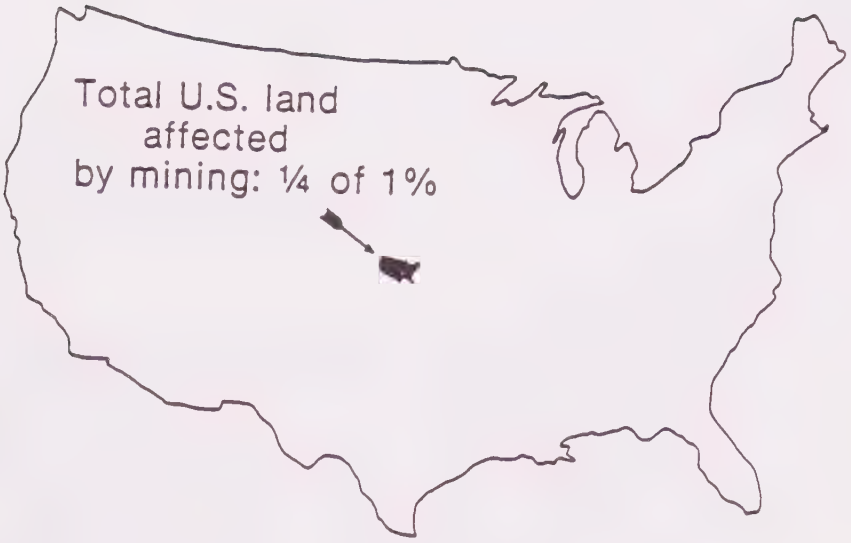
The extraction of minerals is essential to the continued economic well-being of San Bernardino County, Southern California, the State, the Nation and the needs of society. (See Figure 1)

Reclamation

The reclamation of mined lands and lands disturbed by operations ancillary to mining is necessary to mitigate the effects to the environment and to protect the public health and welfare.

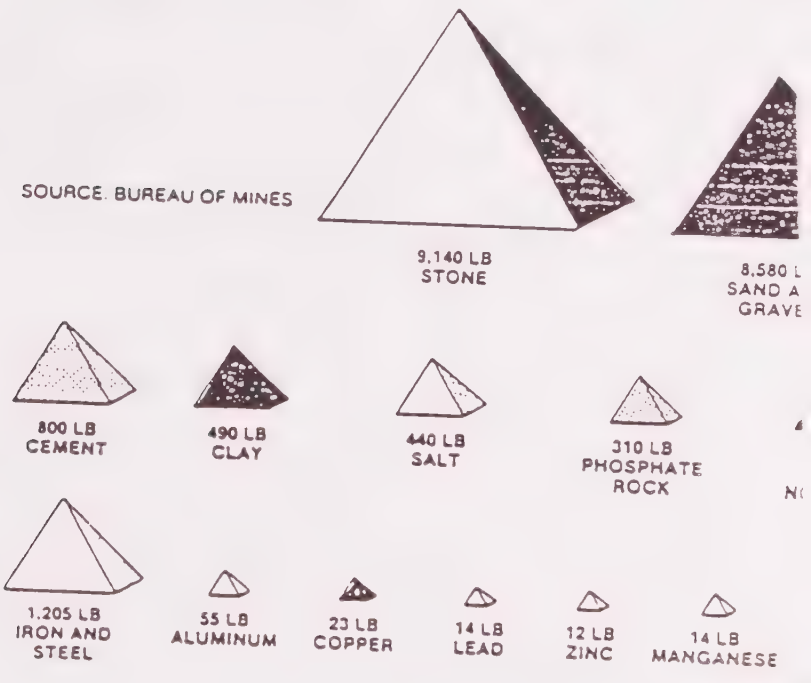
The reclamation of mined lands will provide for the protection and continued beneficial and subsequent use of the mined and reclaimed lands. If possible, the reclamation plan will include provision for future mining of the same areas, if it can be shown that economic mineralization will remain at the conclusion of mining.

FIGURE 1



minerals are where you find them, and the mining of these minerals is essential to all of us.

There are almost 2,000 minerals extracted from the ear[illegible]nd are vital to our basic needs, as well as our comfort, leisure, h safety.



From the first safety pins on our diapers, we depend on mineral above chart shows how many pounds of some minerals each of every year.

Reclamation Planning

Surface mining takes place in diverse areas where the geologic, topographic, climatic, biological and social conditions are significantly different. Mining planning and reclamation planning will vary depending on these conditions.

Mined Lands

These include the surface, subsurface, and ground water of an area in which mining (including wells) will be, are being, or have been conducted, including private ways and roads appurtenant to any such area (including haulage routes), land excavations, workings, mining or operational waste and areas in which structures, facilities, equipment, machines, tools, or other materials or property which result from, or are used in, or for surface mining operations.

Minerals

Minerals are defined as any naturally occurring chemical element or elements or compounds, formed from inorganic processes and organic substances. Minable minerals or an "ore deposit" is defined as a deposit of minerals, or materials having a value materially in excess of the cost of developing, mining, processing the mineral or materials and reclaiming the project area.

Mining Waste

This is the residual soil, rock, mineral, liquid, vegetation, mill tailings, equipment, machines, tools, or other materials or property directly resulting from or displaced by surface mining operations.

On Site Construction

Those earth material moving activities (such as excavation, grading, compaction and the creation of fills and embankments) which are required to prepare a site for construction of structures, landscaping or other land improvements are not deemed to be surface mining operations if:

a) the site that is being disturbed has a Site Approval for such operations and if material that is being moved from the site, to a dump site that also has a Site Approval that allows import of foreign material.

b) With a Site Approval the site or sites of the on-site construction or resultant excavations, fills, grades, or embankments are beneficially modified by such construction of structures, landscaping or other land improvements.

c) Excavations, fills, grades, or embankments that of themselves constitute engineered works such as dams, road cuts, fills, catchment basins, or levees are not considered to be surface mining operations unless they are connected to or are required as part of a mining operation.

Earth material moving activities in areas either on or off-site where the resultant excavations, fills, grades, or embankments will not be beneficially modified by the construction of structures, landscaping or other land improvements, and that do not of themselves consist of engineered works are deemed to be surface mining operations.

Reclamation Plan

The intent of a Reclamation Plan is to:

a) Assure that adverse environmental effects are prevented or minimized and that mined lands are reclaimed to a second use or to a usable condition which is readily adaptable for alternative land uses.

b) The conservation and production of minerals is encouraged, provided their value exceeds the values relating to recreation, watershed, wildlife, range, forage and aesthetic enjoyment.

c) Residual hazards to the public health and safety are eliminated during and after operations.

Environmental Setting

Surface mining takes place in diverse areas where the geologic topographic, climatic, biological and social conditions are significantly different. Mine planning and reclamation planning will vary depending on those conditions, as will the elements and the intensity of the elements of a reclamation plan. While mine planning and reclamation plans will vary from site to site, all

reclamation plans will at least mitigate the following elements:

Public Health and Safety

Giving consideration and mitigation to the degree and type of present and probably future exposure of the public to the site.

Slope Stability and Angle of Repose

The designed steepness and proposed treatment of the mined lands' final slopes shall take into consideration the physical properties of the slope material, its probable maximum water content, landscaping requirements, and other factors. In all cases, reclamation plans shall specific slope angles flatter than the critical gradient for the type of material involved. Whenever final slopes approach the critical gradient for the type of material involved, an engineering analysis of the slope stability shall be required. Special emphasis on slope stability and design shall be necessary when public safety or adjacent property may be affected.

Erosion and Drainage

a. Soil Erosion Control

1. The removal of vegetation and overburden, if any, in advance of surface mining shall be kept to the minimum.

2. Stockpiles of overburden and minerals shall be managed to minimize water and wind erosion.

3. Erosion control facilities such as retarding basins, ditches, streambank stabilization, and diking shall be constructed and maintained where necessary to control erosion.

b. Water Quality and Watershed Control

1. Settling ponds or basins shall be constructed to prevent potential sedimentation of streams at operations where they will provide a significant benefit to water quality.

2. Operations shall be conducted to substantially prevent siltation of ground-water recharge areas.

c. Protection of Fish and Wildlife Habitat

1. Measures shall be taken to protect the habitat of fish and wildlife.

d. Disposal of Mine Waste Rock and Overburden.

1. Permanent piles or dumps of mine waste rock and overburden shall be stable and shall not restrict the natural drainage without suitable provisions for diversion.

e. Grading and revegetation shall be designed to minimize erosion and to convey surface runoff to natural drainage courses or interior basins designed for water storage. Basins that will store water during periods of surface runoff shall be designed to prevent erosion of spillways when these basins have outlet to lower ground.

Resoiling

When the reclamation plan calls for resoiling, coarse hard mine waste shall be leveled and covered with a layer of finer material or weathered waste. A soil layer shall then be placed on this prepared surface. Surface mines that did not salvage soil during their initial operations shall upgrade remaining materials. The use of soil conditioners, mulches, or imported topsoil shall be considered where revegetation is part of the reclamation plan and where such measures appear necessary. It is not justified, however, to denude adjacent areas of their soil, for any such denuded areas must in turn be reclaimed.

Revegetation

When the reclamation plan calls for revegetation, the available research addressing revegetation methods and the selection of species having good survival characteristics, for the topography, resoiling characteristics, and climate of the mined areas shall be used. If no information exists for an area, studies shall be established and testing shall be done to assure adequate revegetation.

Adequacy of a Reclamation Plan

In judging the adequacy of a reclamation plan in meeting the requirements described, San Bernardino County shall consider the physical and land use characteristics of the mined lands and their surrounding area and such characteristics of the property as to the type of overburden, soil stability, topography, geology, climate, stream characteristics and principal mineral commodities. The evaluation and proposals presented in the Reclamation Plan shall be evaluated against that criteria.

II. CURRENT STATUS/ANALYSIS

A. Source of Data and Analysis

The information on mineral resrouces included in this report was derived primarily from the California Division of Mines and Geology and the United States Bureau of Mines. Other information sources include mining industry publications and interviews with those directly involved in the mining industry.

B. Scope of Existing Conditions and Trends

It is difficult to get an exact analysis of production and economic statistics for San Bernardino County. The information required for this analysis is considered proprietary and is given only for statewide statistics. To be able to provide this analysis, some work needs to be done with the mining industry to develop a system that will work.

California again led the nation in production of nonfuel minerals in 1988 with the value of commodities estimated to be $2.851 billion, 12 percent higher than the previous year. (See Figures 2 - 7)

According to preliminary estimates issued late last month by the Bureau of Mines, California was first in production of asbestos, boron minerals, portland cement, diatomite, calcined gypsum, construction sand and gravel, rare-earth metal concentrates and tungsten ore and concentrates.

The state was second to Nevada in production of gold and ranked second in natural calcium chloride, by-product gypsum, magnesium compounds from seawater and sodium compounds.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

CDMG NOTE 40

DISTRIBUTION OF MINERAL RESOURCES IN CALIFORNIA



COUNTY	COUNTY SEAT
Alameda	Oakland
Alpine	Markleeville
Amador	Jackson
Butte	Oroville
Calaveras	San Andreas
Colusa	Colusa
Contra Costa	Martinez
Del Norte	Crescent City
Fresno	Fresno
Glenn	Willows
Humboldt	Eureka
Imperial	El Centro
Inyo	Independence
Kern	Bakersfield
Kings	Hanford
Lake	Lakeport
Lassen	Susanville
Los Angeles	Los Angeles

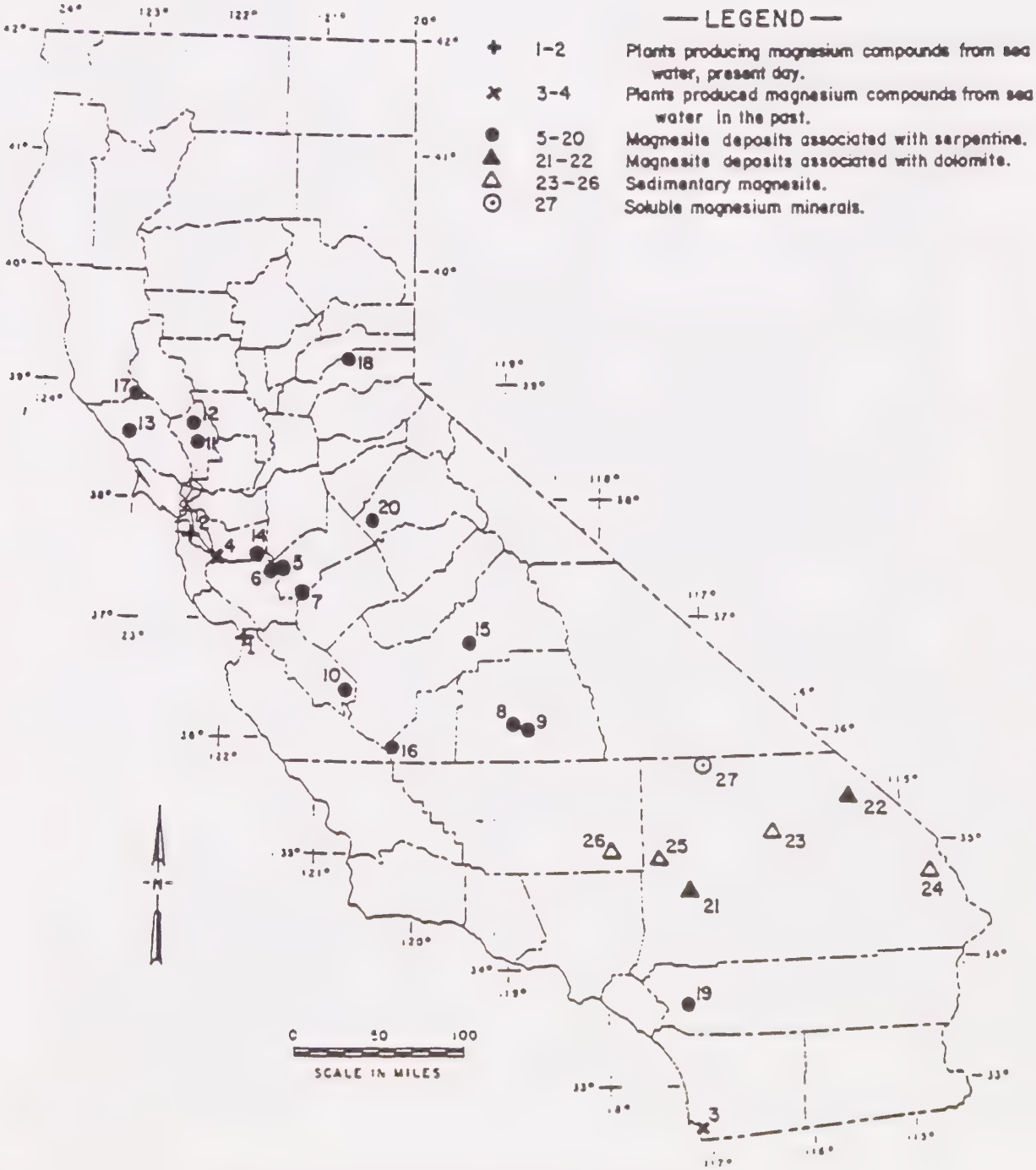
COUNTY	COUNTY SEAT
Madera	Madera
Marin	San Rafael
Mariposa	Mariposa
Mendocino	Ukiah
Merced	Merced
Modoc	Alturas
Mono	Bridgeport
Monterey	Salinas
Napa	Napa
Nevada	Nevada City
Orange	Santa Ana
Placer	Auburn
Plumas	Quincy
Riverside	Riverside
Sacramento	Sacramento
San Benito	Hollister
San Bernardino	San Bernardino
San Diego	San Diego
San Francisco	San Francisco
San Joaquin	San Joaquin
San Luis Obispo	San Luis Obispo
San Mateo	San Mateo
Santa Barbara	Santa Barbara
Santa Clara	Santa Clara
Santa Cruz	Santa Cruz
Shasta	Redding
Sierra	Downieville
Siskiyou	Yreka
Solano	Fairfield
Sonoma	Santa Rosa
Stanislaus	Modesto
Sutter	Yuba City
Tehama	Red Bluff
Trinity	Weaverville
Tulare	Visalia
Tuolumne	Sonora
Ventura	Ventura
Yolo	Woodland
Yuba	Marysville

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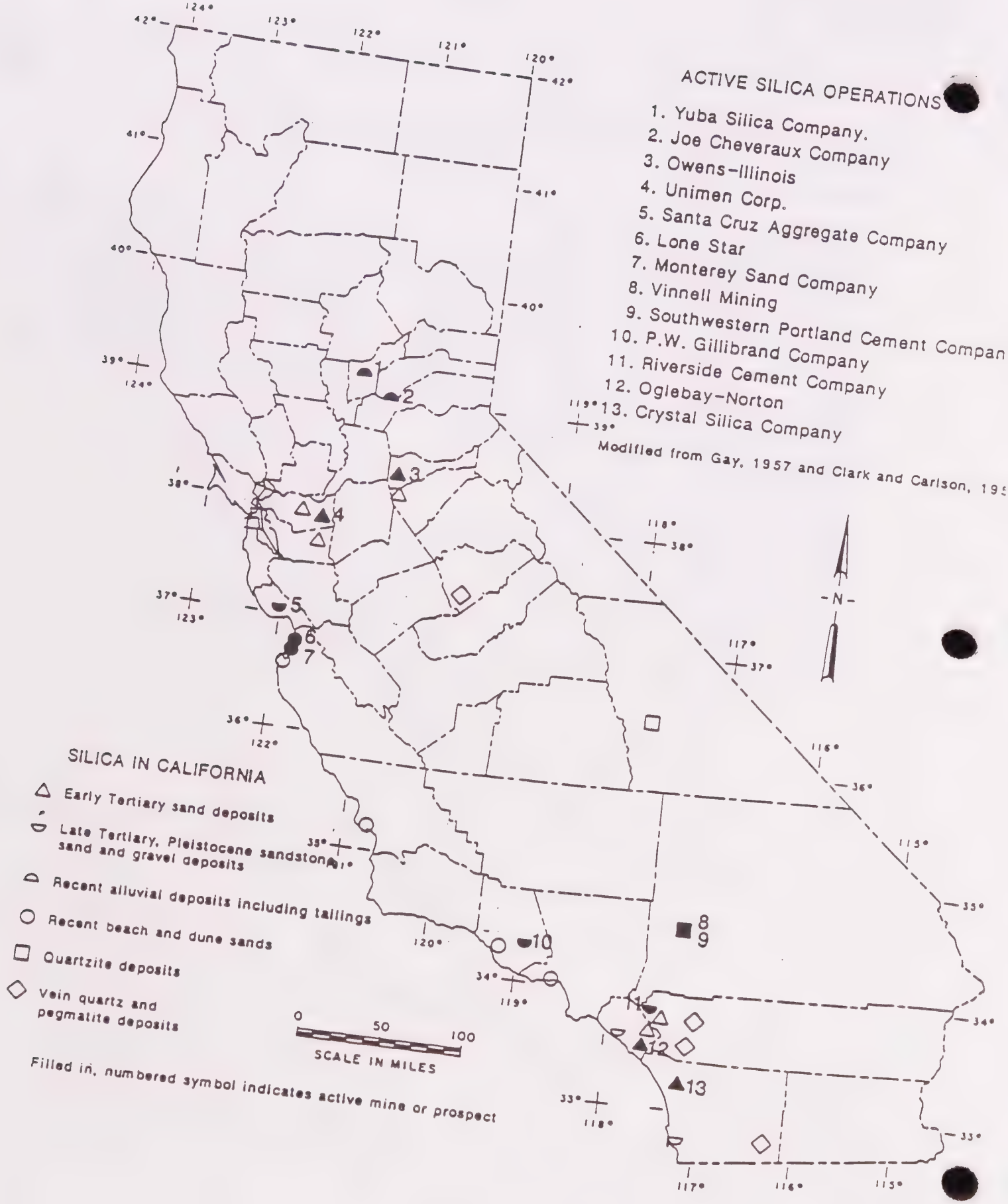
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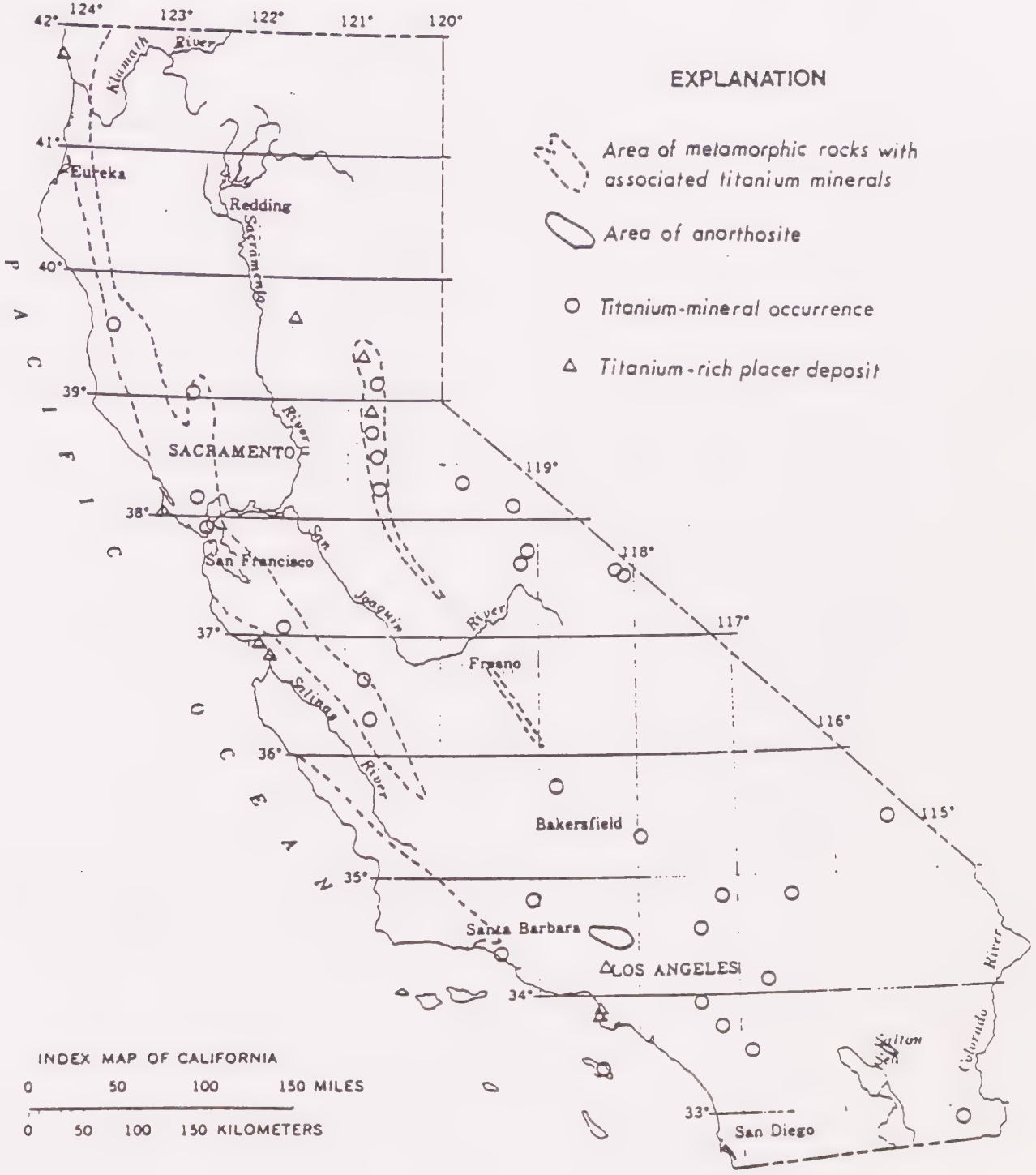
STATE OF CALIFORNIA THE RESOURCES AGENCY DEPARTMENT OF CONSERVATION

For a list of geologic maps and reports available from the California Division of Mines and Geology, write to the California Division of Mines and Geology, P.O. Box 2980, Sacramento, CA 95812, or visit our District offices in SACRAMENTO, 2815 "O" Street, (916) 445-5716; SAN FRANCISCO, Room 2022, Ferry Building, (415) 557-0633; LOS ANGELES, Room 1065, 107 South Broadway, (213) 620-3560.

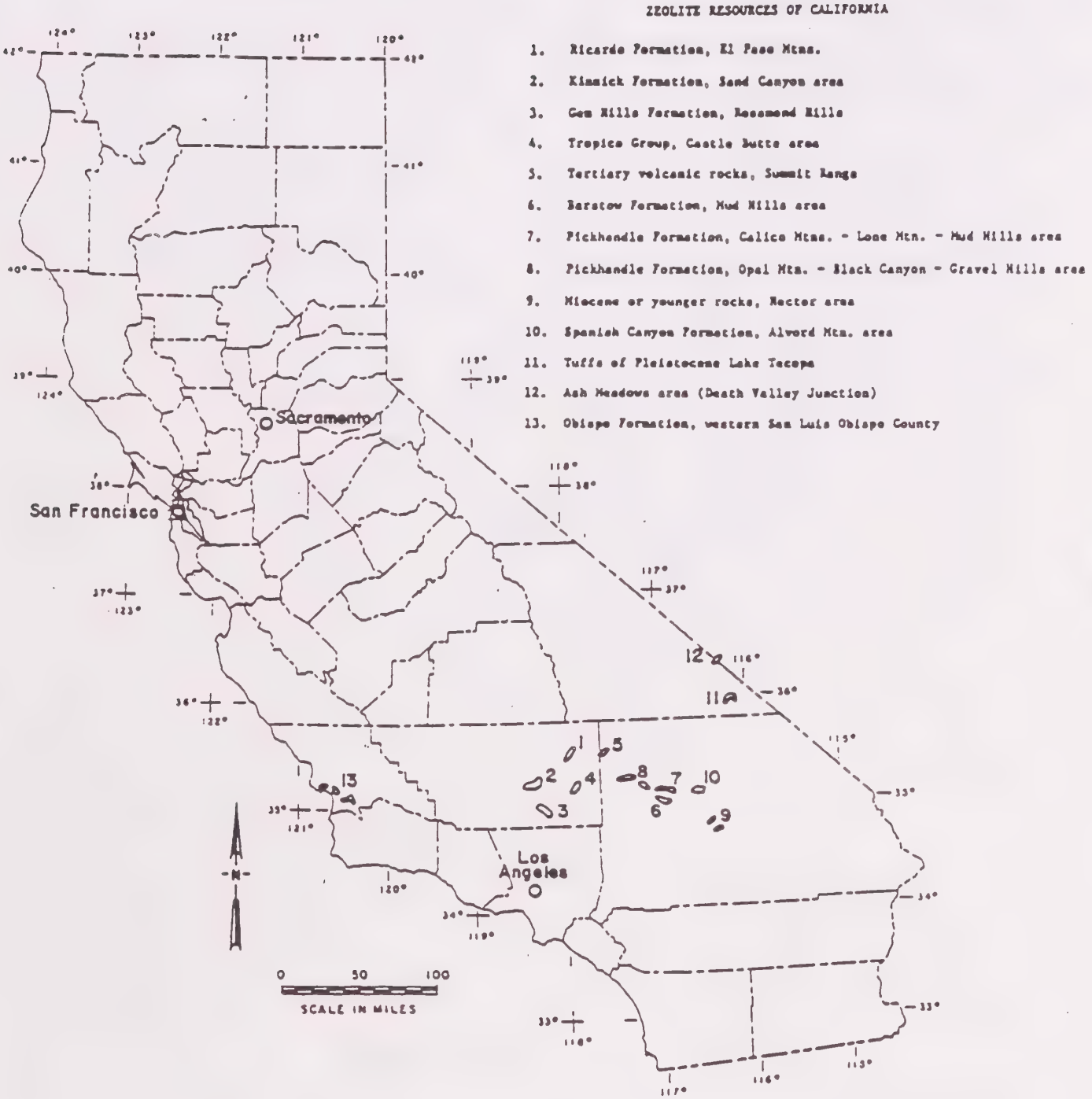


Magnesium Compounds deposits in California


ACTIVE SILICA OPERATIONS
1. Yuba Silica Company.
2. Joe Cheveraux Company
3. Owens-Illinois
4. Unimen Corp.
5. Santa Cruz Aggregate Company
6. Lone Star
7. Monterey Sand Company
8. Vinnell Mining
9. Southwestern Portland Cement Compan
10. P.W. Gillibrand Company
11. Riverside Cement Company
12. Oglebay-Norton
13. Crystal Silica Company
Modified from Gay, 1957 and Clark and Carlson, 19
SILICA IN CALIFORNIA
Early Tertiary sand deposits
Late Tertiary, Pleistocene sandstone, sand and gravel deposits
Recent alluvial deposits including tailings
Recent beach and dune sands
Quartzite deposits
Vein quartz and pegmatite deposits
Filled in, numbered symbol indicates active mine or prospect
0 50 100
SCALE IN MILES
N

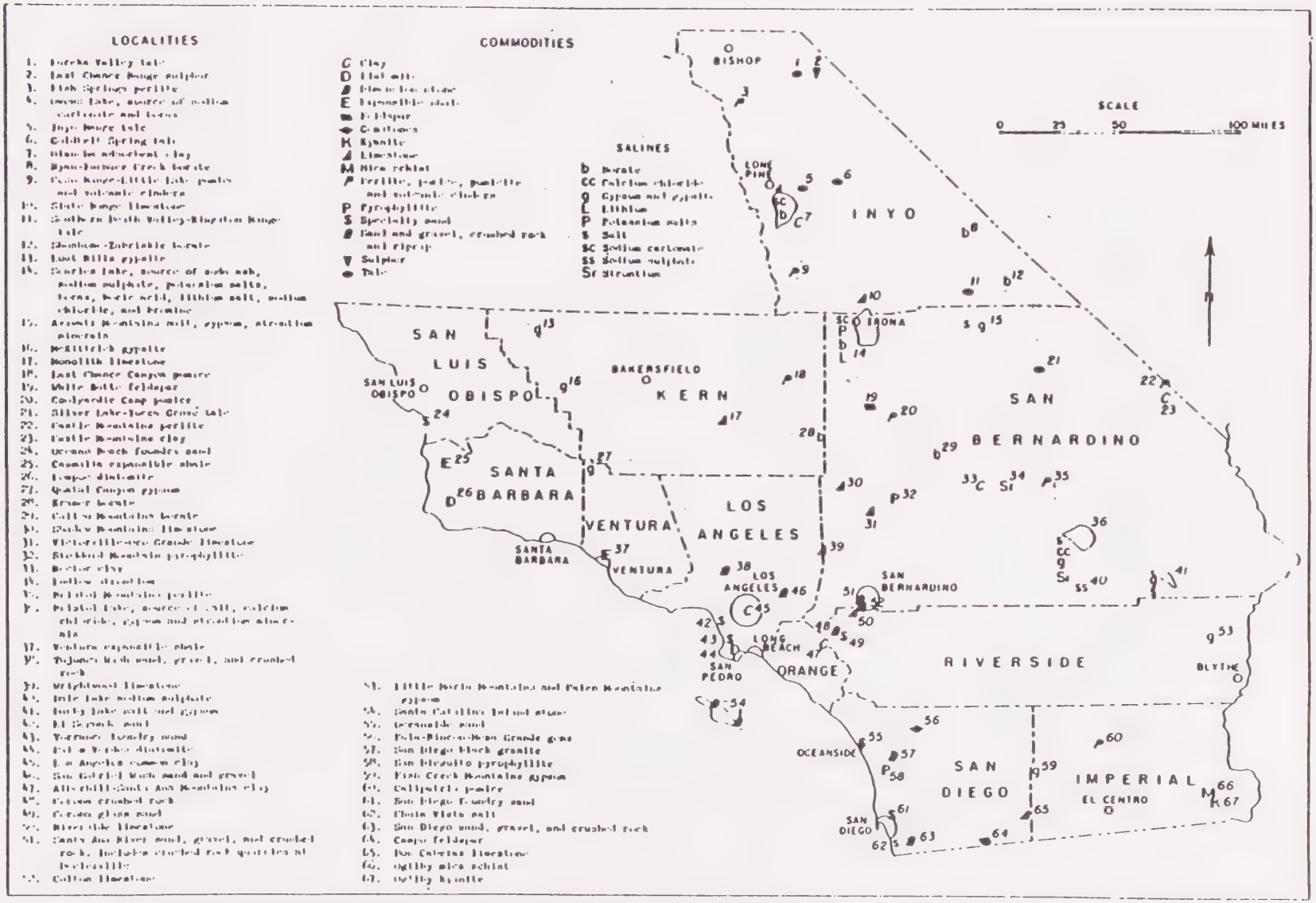


Location of California titanium occurrences.



Locations of California zeolite deposits.

MINERAL DEPOSITS AND MINERAL INDUSTRY



Index map of southern California showing locations of nonmetallic mineral resources. Stippled areas contain numerous deposits of the indicated commodity.

Showing both production and value increases in 1988 were portland cement, clays and crushed stone.

The production of gold in California in 1988 is estimated at 729,272 troy ounces valued at $320.1 million, up from $269.9 million in 1987 and more than double the 1986 figure of $156.7 million.

There are 46 mineral commodities produced in the desert including 97% of the nation's rare earths, 100% of the boron minerals, 15% of the talc, 10% of the crude gypsum, and 6% of the metallic minerals.

Mining directly provides approximately 2,500 jobs in San Bernardino County and indirectly provides approximately 22,500 additional jobs. Other than leading the nation in the production of non-fuel minerals, mining provides a substantial number of jobs. (See Table 1)

The current trend in mining has been for increased exploration, development and production. New projects are being proposed yearly and California has continued to lead the nation. On the other hand, no growth regulations and opposition to new permits is slowing the start of new mining operations throughout the state. Current legislation is being proposed to withdraw from free use, a large portion of the California desert. The legislation proposed to turn 8 million acres of the California desert into national parks and wilderness areas. A large portion of the 8 million acres is located in San Bernardino County. The 8 million acres is an area approximately two-thirds the area of San Bernardino County.

1. General Provisions

The California Surface Mining and Reclamation Act (SMARA) of 1975 was passed to identify and protect mineral resources in areas of high land use conflict and ensure reclamation of mined lands.

While many states and the federal government had previously enacted mined land reclamation laws, California was the first to address the issue of long-term mineral resource availability. The first article of SMARA states, "The Legislature hereby finds and declares that the extraction of minerals is essential to the continued economic well being of the state and to the needs of the society, and that the reclamation of mined lands is necessary to prevent or minimize adverse effects on the environment and to protect the

TABLE 1

NONFUEL MINERAL PRODUCTION IN CALIFORNIA 1/ *(U.S. Bureau of Mines and Division of Mines and Geology).*

Minerals	1986 Quantity	1986 Value (thousands)	1987 p/ Quantity	1987 p/ Value (thousands)
Boron minerals ---- thousand short tons	1,251	$426,086	W	W
Cement (portland) ---- do	9,490	$78,502	10,100	$615,700
Clays 2/ ---- do	2,449	33,289	2,455	33,277
Gem stones	NA	418	NA	1,435
Gold (recoverable content of ores, etc.) ---- troy ounces	425,617	156,729	602,071	267,320
Gypsum ---- thousand short tons	1,378	10,777	1,387	10,848
Lime ---- do	371	24,187	425	27,707
Pumice ---- do	46	1,263	44	1,309
Sand and gravel:				
Construction ---- do	128,407	498,456	e/ 135,700	e/ 536,800
Industrial ---- do	2,364	44,813	2,100	37,500
Silver (recoverable content of ores, etc.) ---- thousand troy ounces	155	849	63	450
Stone:				
Crushed ---- thousand short tons	e/ 38,500	e/ 159,300	38,700	171,800
Dimension ---- do	e/ 23	e/ 2,582	25	2,905
Talc and pyrophyllite ---- do	64	1,528	42	922
Combined value of asbestos, barite (1987), calcium chloride (natural), cement (masonry), clays (ball clay, 1986, fire clay, 1985), copper, diatomite, feldspar, iron ore (usable), magnesium compounds, molybdenum, peat, perlite, potassium salts, rare-earth metal concentrates, salt, sodium carbonate (natural), sodium sulfate (natural), tungsten ore and concentrates, wollastonite (1986-87), and values indicated by symbol W ----	XX	330,638	XX	801,528
Total ----	XX	2,269,417	XX	2,509,501

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data, value included with "Combined value" figure. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ May exclude certain clays; values will be included with "Combined value" figure.

public health and safety." This landmark statement was, at the time of its passage, unique in its recognition of the importance of mineral resources, giving them an equal footing with other natural resources.

Under SMARA, local government retains all land use decision making authority (a constitutionally guaranteed right in California) relative to the granting of mining permits. Local government however, generally lacks the fiscal resources, technical expertise, and regional perspective to prepare an accurate geologic inventory of mineral resources under their jurisdiction. Similarly, they cannot be ensured a consistent inventory by neighboring jurisdictions, let along consistency on a statewide basis. Responsibility for preparing an accurate, objective, quantified aggregate resource data base was, therefore, given to the State.

SMARA has resulted in the creation of three closely related programs within DMG - Urban SMARA, Country SMARA, and Mined Land Reclamation. The three programs are guided by the California Department of Conservation and State Mining and Geology Board, where the authority for resource designation rests. Appropriately, the SMARA program is now funded by a portion of the monies derived from mining activities on federal lands within California, dispersed each fiscal year by the federal government to the State pursuant to the Mineral Lands Leasing Act.

Similarly, local jurisdictions may not be able to put the regional significance of mineral resources into perspective. Local jurisdictions also lack the fiscal resources to monitor and regulate these resources. The County has the resources and the ability to regulate the regional significance of these resources. The County should oppose the annexation of these areas and the buffer zone surrounding them.

2. Mineral and Community Management

For years, many of California's community land use plans disregarded mineral resource management. Planning strategies were concentrated in areas such as urban growth, commercial and industrial development, and recently, high technology development.

In the last decade, the price of minerals and the advancements in technology, especially for gold, has increased significantly, causing renewed interest in mining the gold reserves and other minerals. In 1975, the State of California adopted the Surface Mining and Reclamation Act, which mandates the Division of Mines and Geology to identify and map the locations of economically important minerals. Classification maps are prepared and distributed to city and county agencies to serve as a basis for amending General Plans to include mineral resource management policies.

The current situation in the world market for precious and industrial grade minerals and metals indicates that mining activities will increase dramatically, fueling even more dispute and conflict among property owners, residents, mine operators, and local government officials. Mineral extraction creates public controversy and court challenges to both mine operators and public officials.

Minerals and metals constitute a resource that must be harvested in order to meet the demands of an industrial, technological society. At the same time, it is important that conservation efforts be employed to assure future supplies of these resources. The need, then, is for mineral resource management planning comparable to the resource management planning that is applied to timber, oil, water, agricultural land, and other finite natural resources.

To institute a realistic plan of mineral harvesting and conservation, it is essential that government entities, mining operators, and the general public undertake a cooperative effort to better understand basic mining operations and to better define the needs of neighboring landowners and residents.

Mining operations carried out during California's Gold Rush days were conducted with little or no concern for the environment. Mountains and streams were altered by hydraulic mining and manual labor. Sediment from placer mining choked creeks, streams, and rivers, causing flooding and turbidity. Hard rock mining exposed heavy metals that produced toxic, acidic leachates. Other toxic materials were washed into creeks and rivers from the chemicals used in extracting gold from the ore.

When the gold was depleted, the miners walked away, leaving the mine tailings, waste dumps, open pits, and open mine shafts for future generations. As time passed, nature covered the legacy of devastation left by these activities, and the Gold Rush Era passed into history as a romantic, swashbuckling period in the early days of California.

California has experienced an influx of people, people who, while they are aware of the historic mining activity that contributes so greatly to the attraction of California, did not anticipate the resurgence of large-scale mining in their new communities.

Mining was considered a secondary land use by many agencies until 1975, and little specialized land use planning was undertaken for such activities. The usual approach was to identify extraction activities that could be conducted under the provisions of a conditional use permit. Conditional use permit applications and procedures were believed to provide adequate means for public comment and consideration of mining as a land use.

Clearly, a modern, and more comprehensive approach to mineral mining is required to meet the needs and demands of mining operators, local governments, communities, and an industrialized society.

Mineral management planning begins with an inventory of known mineral deposits. Efforts are then directed to identification of areas where additional deposits may be found. Land uses in surrounding areas must be assessed carefully to determine the feasibility of mining, either at the current time, or in the future. General Plan elements and zoning ordinances should be formulated to deal specifically with mineral mining within the jurisdiction. It may be deemed best to restrict other types of development in areas that have been set aside as future mining sites, or it may be possible to allow only compatible types of development in these areas. Whatever approach is taken, it would be wise to discourage residential, or commercial building in the immediate vicinity of these reserves.

Attention must be given to the communities in or near which the minerals are found, and provisions made to prevent undue disruption in the daily

lives of established residents. Whenever possible, land use planning should be designed to forestall controversy within the community over mining issues, rather than seeking to resolve problems after they have developed. To succeed, it will be necessary for local jurisdictions to act rapidly in developing and enacting comprehensive mineral management plans.

Another vital aspect of mineral management is communication with the community. Public perspectives of mineral mining range from indifference to open hostility and suspicion. Efforts to provide public information should be directed toward increasing awareness of the importance of available mineral resources, both as raw materials for industry and science, and as economically remunerative products for the community and the region. A proper appreciation of the value of these natural resources can assist greatly in making mineral mining a land use compatible with other types of development.

3. Strategic Mineral Commodities

San Bernardino County has known deposits of a large variety of minerals and metals. They include clays, salts, talc, manganese, dolomite, limestone, perlite, tungsten, iron ore, copper, silver, zinc, gold, lanthanides minerals group, borates, potash, soda ash, magnesite, quartzite, titanium, zeolite, calcium chloride, gypsum, graphite, feldspar, strontium, sodium sulphate, lithium, potassium, sand and gravel, and crushed rock. (See Figures 2 - 7) Of these mineral resources, eleven (11) are considered "strategic". Strategic minerals are those which are in short domestic supply, or which are important to the national defense or the well-being of the domestic economy. Table 2 identifies those minerals and metals which are considered to be strategic and critical by the U.S. Bureau of Mines. In this County, they include manganese, talc, copper, silver, zinc, tungsten, quartzite, titanium, strontium and graphite. Copper, quartz crystals, strontium and tungsten are on the National Stockpile list. The remainder have a net import reliance of 50% or greater.

TABLE 2

LIST OF STRATEGIC AND CRITICAL MINERALS AND METALS *

Commodity	Strategic Rating
Antimony	SX
Arsenic	X
Asbestos	SX
Barite	X
Bauxite and Alumina	SX
Beryllium	S
Bismuth	SX
Cadmium	SX
Chromium	SX
Cobalt	SX
Columbium	SX
Copper	S
Diamond (industrial)	SX
Fluorspar	SX
Germanium	S
Graphite	SX
Iodine	SX
Lead	S
Manganese	SX
Mercury	SX
Mica (sheet)	SX
Nickel	SX
Platinum (group)	SX
Potash	SX
Quartz Crystals	S
Rutile	S
Silver	X
Strontium	X
Talc, Steatite Block and Lump	S
Tantalum	SX
Tin	SX
Titanium	S
Tungsten	SX
Vanadium	S
Yttrium	X
Zinc	SX

X = Net import reliance of 50 percent or more in 1987.
S = On National Defense Stockpile List (9/30/87).

Source: U.S. Bureau of Mines

*San Bernardino County has the same inport reliance on minerals that are identified as having an import reliance to the United States as a whole.

GLOSSARY OF TERMS

Angle of Repose: The maximum angle of slope (measured from a horizontal plane) at which loose cohesionless material will come to rest on a pile of similar material. The angle is generally a few degrees less than the angle of internal friction of the same material.

Critical Gradient: The maximum stable inclination of an unsupported slope under the most adverse conditions that it will likely experience, as determined by current engineering technology.

Grading: To bring an existing surface by cutting, filling and/or smoothing operations to a designed form.

Mined Lands: These include the surface, sub-surface and groundwater (including wells) of an area in which surface mining operations will be, are being, or have been conducted, including private ways and roads appurtenant to any such area (including haulage routes) land excavation, workings, mining waste and areas in which structures, facilities, equipment, machines, tools, or other materials or property which result from, or are used in mining are located.

Minerals: Naturally occurring chemical element or elements or compounds, formed from inorganic processes and organic substances. Minable minerals or an "ore deposit" is defined as a deposit of minerals, or material having a value materially in excess of the cost of developing, mining, processing the mineral or materials and reclaiming the mined lands.

Permit: A formal authorization approved by the County Planning Commission or the County Board of Supervisors.

Reclamation: The combined process of land treatment that minimizes water degradation, air pollution, damage to aquatic wildlife habitat, flooding, erosion, and other effects from surface mining operations including adverse surface effects incidental to underground mines, so that mined lands are reclaimed to a usable condition which is readily adaptable for alternate land uses and creates no danger to public health, welfare and safety. The process may extend to affected lands, surrounding mined lands and may require backfilling, grading, slope stability, erosion and drainage control, resoiling, revegetation, soil reconditioning, clean up of the areas and other measures.

SECTION II

MAN-MADE RESOURCES

WASTEWATER

WASTEWATER COLLECTION/TREATMENT

I. INTRODUCTION

Wastewater collection, treatment and disposal, including reclamation is one of the many public services in San Bernardino County which is undertaken by various units of local government, including cities and various types of special districts, both self-governed and Board of Supervisors-governed. Where public collection and treatment of wastewater is not available, privately owned systems are required in the form of septic tanks or package treatment plants, which normally serve individual users and groups of users respectively. The treatment of wastewater is vital to developed and developing urban areas, and is also vital in less developed rural areas for obvious reasons of public health due to the large number of insects, rodents, and resultant diseases that can be generated and transmitted by untreated or inadequately treated wastewater. Perhaps a less obvious but equally valid reason for the controlled collection and treatment of wastewater is the protection of groundwater quality, as groundwater is by far the major source of domestic water supply in San Bernardino County.

The operation of public wastewater collection and treatment systems is exclusively undertaken by public agencies, as opposed to private enterprise, which usually indicates that it is not a profit-making venture. In the County of San Bernardino public wastewater collection and treatment is carried out by a combination of 1) regional wastewater agencies which serve several cities and communities, 2) city operated collection and treatment facilities serving the area within the city and sometimes adjacent cities and unincorporated areas, and 3) special districts serving unincorporated communities.

The overall wastewater issue ultimately affects everyone in the County, regardless of the type of wastewater disposal utilized at their dwelling or place of employment, as the State Regional Water Quality Control Boards (RWQCBs) are constantly reviewing their requirements for wastewater discharges and the suitability of areas for on-site sewage disposal systems (septic tanks) in areas not served by public collection and treatment facilities. Within the County, there is a range of issues related to the collection and treatment of wastewater, including:

- The identification and inventory of wastewater collection and treatment facilities, and their service areas.

- The adequacy of collection and treatment systems for both the existing and projected population's domestic flows as well as industrial commercial, and agricultural flows, which may be incompatible with the treatment of domestic wastewater.

- The need to monitor and assess collection and treatment facilities, and the frequency of such assessment.

- The requirement for "dry sewers" in areas not currently served by collection and treatment facilities.

- On-site sewage disposal systems, such as septic tanks and package treatment plants, in areas with no wastewater collection and treatment facilities.

- The density of development to be permitted in areas which are not served by wastewater collection and treatment facilities, and must therefore rely on septic systems or other on-site systems.

- Requirements of the Regional Water Quality Control Boards (Santa Ana, South Lahontan, and Colorado River) in San Bernardino County as regards the discharge from wastewater collection and treatment systems.

- The level of treatment required: primary, secondary, advanced secondary, and tertiary. What levels are necessary to meet Federal and State requirements?

- Funding for required expansion of facilities: who pays, how much, when, and what is the County's role?

It is the intent of this section of the background appendix to identify, inventory, quantify, and describe wastewater collection and treatment facilities from a county-wide perspective. Furthermore, agencies that play a role in this issue will be identified and their function described.

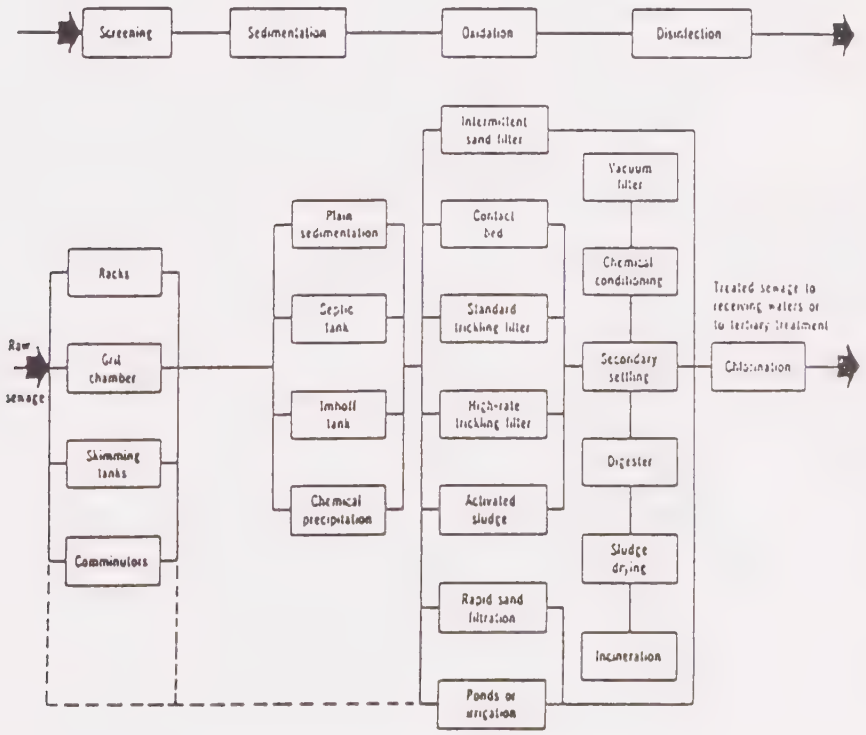
The wastewater collection and treatment issue is part of the overall Man-Made Resources Component of the General Plan, which is intended to establish a framework for the coordination of the County's land use planning process with the planning of public services and facilities. It should be noted that sections of the background appendix on the related issues of groundwater supply and quality, water distribution systems, and solid waste management have also been prepared; there may be a degree of overlap between

these sections and the wastewater section. It is the intent in this wastewater section to focus as much as possible on wastewater collection and treatment systems and leave the above-mentioned topics to be covered in separate sections of the background appendix.

A. Definitions

Wastewater can be defined simply as water that has been used, or sewage. Wastewater collection is achieved by a system of sewers which convey the sewage from individual dwellings or other structures to a treatment plant where the solids are separated from the liquids in the beginning of the treatment process. From that point the degree of treatment is determined by local requirements set forth by the Regional Water Quality Control Boards (RWQCBs).

Typical wastewater treatment is usually defined, in order of magnitude, as primary treatment, secondary treatment, or tertiary treatment, although other terms are also used such as advanced secondary treatment or advanced wastewater treatment.



Conventional Sewage Treatment Process Fig. 1

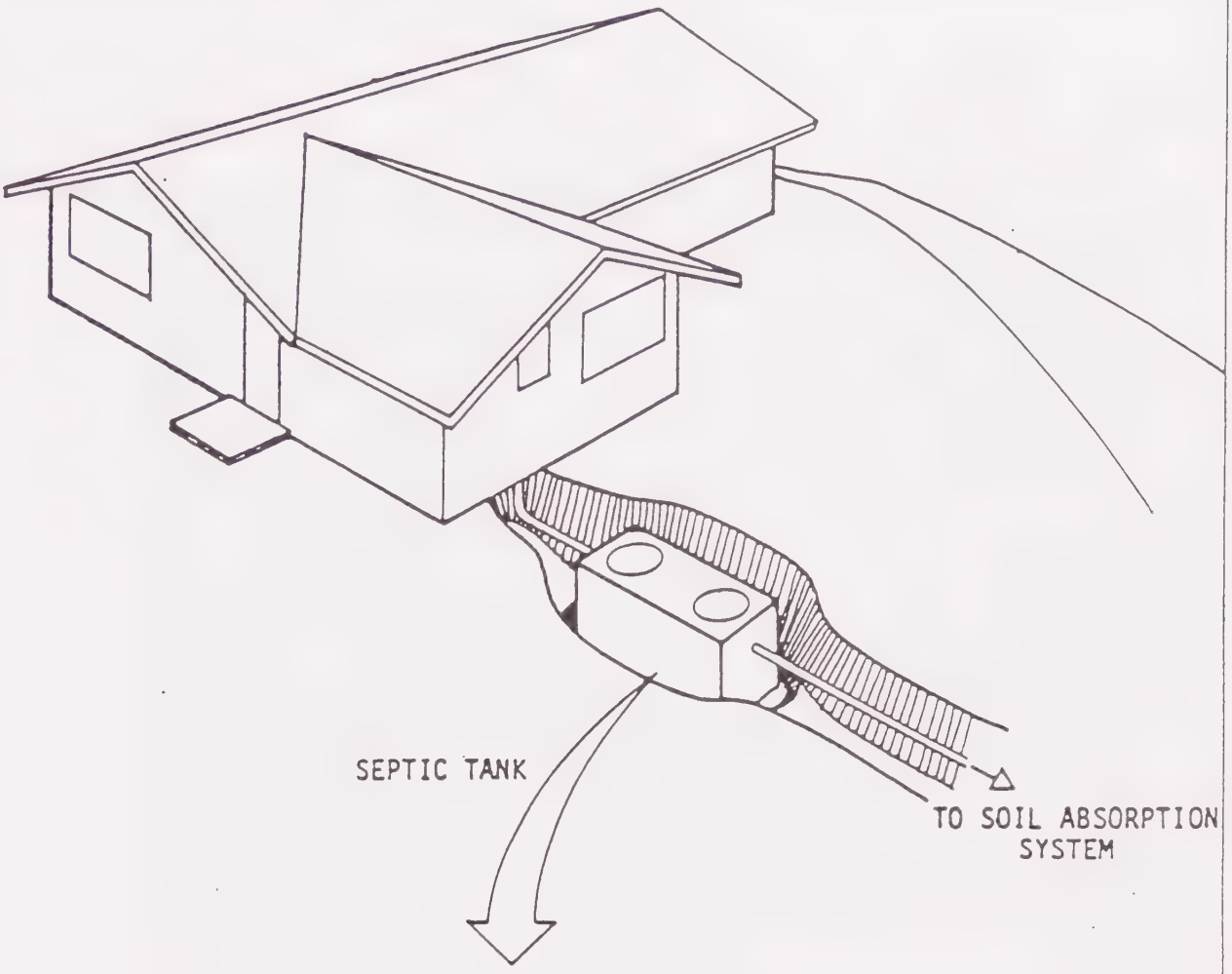
Primary treatment is the first major treatment, and consists of the settlement of raw sewage to accomplish the separation of solids and liquids. A septic tank system with a leachfield or seepage pit for soil absorption is an example of primary treatment. A few large treatment systems also utilize this process with no further treatment, such as the system operated by CSA 82 in Trona. Fig. 2 indicates a typical septic disposal system, a concrete septic tank.

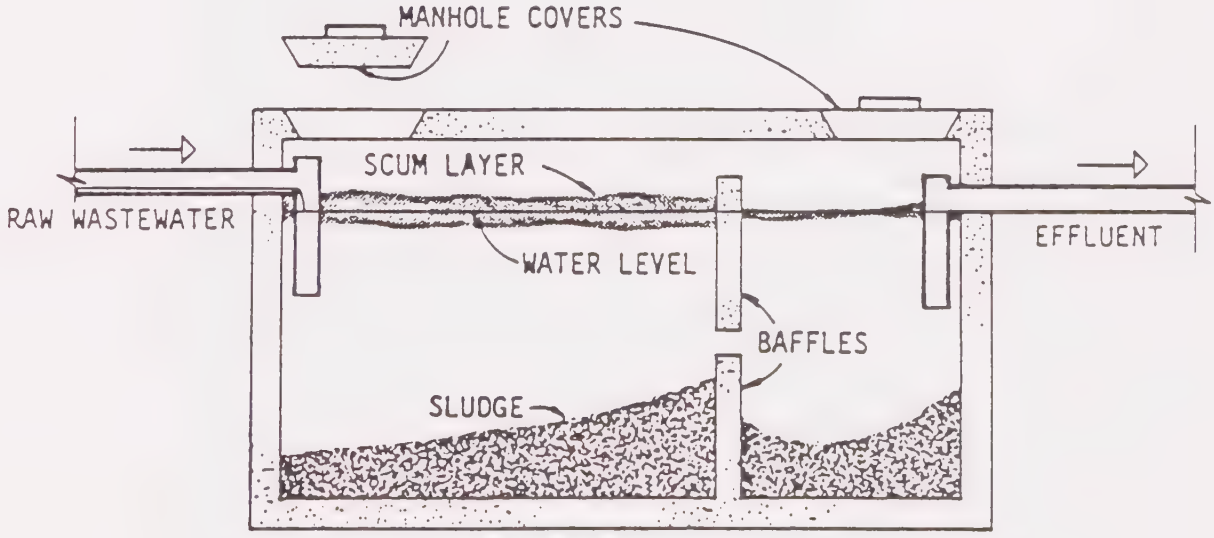
Secondary treatment carries the process one step further by providing a biological process which removes fine suspended solids, BOD, and COD from wastewater. Many of the treatment plants in San Bernardino County treat wastewater to this level. Fig. 3 illustrates a typical wastewater treatment plant providing treatment at secondary level.

Tertiary treatment is an advanced treatment employing any physical, chemical, or biological process to accomplish a degree of treatment greater than secondary treatment. The effluent produced by this treatment is generally suitable for reuse. The regional wastewater treatment plants of the Chino Basin Municipal Water District are the only plants in the County known to provide full tertiary treatment. The Victor Valley Wastewater Reclamation Authority plant in Oro Grande provides for advanced secondary treatment, and other plants may provide partial tertiary treatments. At present, however, there is much discussion and debate over the possibility of requirements for treatment at this level in the County's East and West Valley Planning areas by the Santa Ana RWQCB.

Wastewater treatment plants are at the receiving end of sewage collection systems, and are also known as sewage treatment plants (STPs), publicly owned treatment works (POTWs), or regional plants (RPs). Package treatment plants, which are generally operated by a developer or homeowners' association, are a small scale treatment operation.

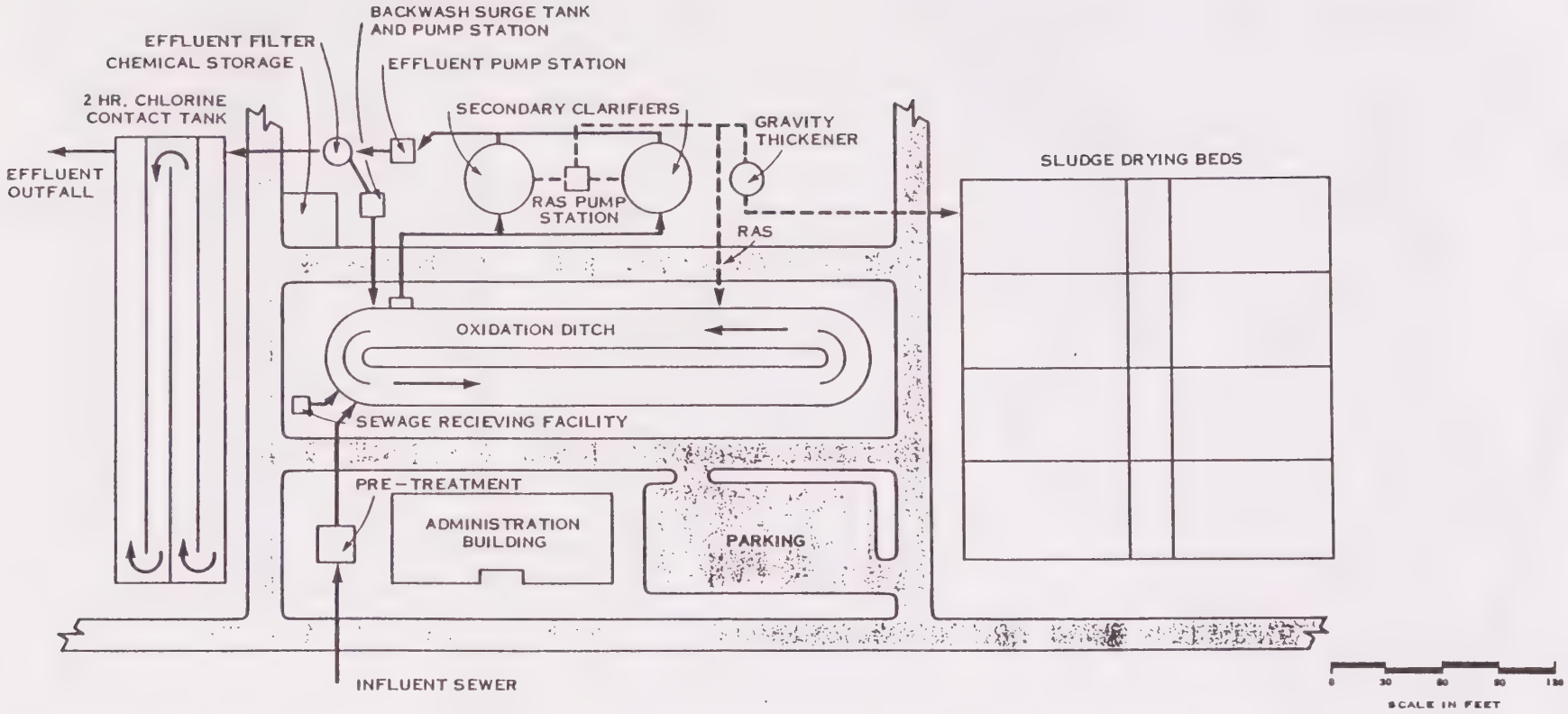
The first and foremost reason for wastewater collection and treatment is, as previously mentioned, the protection of public health. This alone is one reason why wastewater collection and treatment should be controlled by public health agencies. Wastewater, or sewage, can be subdivided into "blackwater" which drains down the toilet, or "greywater" which drains from other plumbing fixtures such as sinks, tubs, shower, etc.





TYPICAL CONCRETE SEPTIC TANK

Fig. 2



TYPICAL FACILITIES LAYOUT
(1.2 MGD, 4.5 ACRES)

Fig. 3

Sewage which is not drained away will quickly become a public nuisance by generating odors, attracting rodents, and becoming a breeding ground for mosquitoes and flies. As a health hazard, sewage can also contain eggs and larvae of parasitic worms, microbial pathogens, and parasites. Of the five most common human parasitic diseases (ascariasis, hookworm, malaria, trichuriasis, and amoebiasis) only malaria is not directly spread by sewage. Tables 1 and 2 give the reader an idea of the number of viruses, bacteria, and parasites found in sewage and the diseases which may be caused.

In order to carry out an assessment of the adequacy and availability of community wastewater facilities in a county the size of San Bernardino County, with three separate State Regional Water Quality Control Boards regulating discharges and treatment of wastewater, an inventory has been carried out along with an analysis of the hierarchy of agencies and their relationships. This section of the background appendix will therefore identify the agencies involved in the collection and treatment of wastewater within the County and present data gathered from as many sources as possible in trying to describe the complex issues of wastewater systems.

II. CURRENT STATUS

A. Sources of Data/Analysis

Information has been gathered on the wastewater issue from agencies at state, regional, and local levels. At state and regional level, the Regional Water Quality Control Boards for the Santa Ana Region, the Lahontan Region, and the Colorado River Region (all of which operate within different geographic regions of San Bernardino County) have made available their Water Quality Control Plans and lists of wastewater treatment facilities within their respective areas. At a regional and county level, information has been obtained from the Southern California Association of Governments (SCAG), Santa Ana Watershed Project Authority (SAWPA), Chino Basin Municipal Water District (CBMWD), Victor Valley Wastewater Reclamation Authority (VVWRA), and San Bernardino County Department of Environmental Health Services (DEHS). At local level data has been obtained from individual collection/treatment systems and from DEHS.

As part of the effort to organize and analyze data gathered from various sources, the San Bernardino

Table 1
Human Enteric Viruses in Sewage

Virus	Number of Types	Diseases Caused
Enteroviruses:		
Poliovirus	3	Meningitis, paralysis, fever
Echovirus	31	Meningitis, diarrhea, rash, fever, respiratory disease
Coxsackie virus	23	Meningitis, herpangina, fever, respiratory disease
Coxsackie virus	6	Myocarditis, congenital heart anomalies, pleurodynia, respiratory disease, fever, rash, meningitis
New enteroviruses (Types 68-71)	4	Meningitis, encephalitis, acute hemorrhagic conjunctivitis, fever, respiratory disease
Hepatitis Type A (enterovirus 72?)	4	Infectious hepatitis
Norwalk virus	1	Diarrhea, vomiting, fever
Calicivirus	1	Gastroenteritis
Astrovirus	1	Gastroenteritis
Reovirus	3	Not clearly established
Rotavirus	2	Diarrhea, vomiting
Adenovirus	37	Respiratory disease, eye infections

Source: EPA-625/1-83-016.

Table 2
Bacteria and Parasites in Sewage and Sludge

Group	Pathogen	Disease Caused
Bacteria	Salmonella (1700 types)	Typhoid, paratyphoid, salmonellosis
	Shigella	Bacillary dysentery
	Enteropathogenic *Escherichia coli*	Gastroenteritis
	Yersinia enterocolitica	Gastroenteritis
	Campylobacter jejuni	Gastroenteritis
	Vibrio cholerae	Cholera
	Leptospira	Weil's disease
Protozoa	*Entamoeba histolytica*	Amebic dysentery, liver abscess, colonic ulceration
	Giardia lamblia	Diarrhea, malabsorption
	Balantidium coli	Mild diarrhea, colonic ulceration
Helminths	*Ascaris lumbricoides* (Roundworm)	Ascariasis
	Ancyclostoma duodenale (Hookworm)	Anemia
	Necator americanus (Hookworm)	Anemia
	Taenia saginata (Tapeworm)	Taeniasis

Source: EPA-625/1-83-016.

County Land Management Department has contracted with a consultant, URS Corporation, to design a computerized system for the assessment of the availability of various public services, one of which is wastewater collection/treatment. The first phase of the system development has been completed. However, the system will not be fully operational prior to the completion of the two-year General Plan Update, but may continue as part of the five-year program.

The County's Victor Valley Infrastructure Enhancement Program (VVIEP), which commenced in early 1986 and was completed in November 1988, identified overall public service demands and needs in that area of the North Desert, including wastewater collection/treatment. Information from this project has been utilized to the maximum extent possible for the Victor Valley area.

B. Scope of Existing Conditions/Trends

1. The Regional Water Quality Control Boards (RWQCBs)

At the State level, California's water quality management regions were established in 1949. The Porter-Cologne Act, 1969, subsequently required regional water quality control plans. The early 1970's saw the completion of the first plans, which specify the objectives of surface and ground water quality. The evolution of these regional plans is linked directly to the issue of wastewater collection and treatment.

Discharges of wastewater is regulated by the Regional Water Quality Control Boards (RWQCBs) through the issuance of waste discharge requirements set forth in their regional plans. The State Water Resources Control Board (SWRCB) oversees the RWQCBs and establishes water quality policies at the state level.

In the County of San Bernardino there are three RWQCBs, each with its own water quality control plan which, among other things, forms the basis for the regulation and control of wastewater treatment and discharges. The three RWQCBs are as follows:

- Santa Ana Region
- Lahontan Region
- Colorado River Region

Fig. 4 illustrates the location of the above Regions and others in the vicinity from a Southern California regional perspective.



SA - SANTA ANA

SL - SOUTH LAHONTAN

CR - COLORADO RIVER

SD - SAN DIEGO

TL - TULARE LAKE

LA - LOS ANGELES

Regional Water Quality Control Boards in the Southern Calif. Region

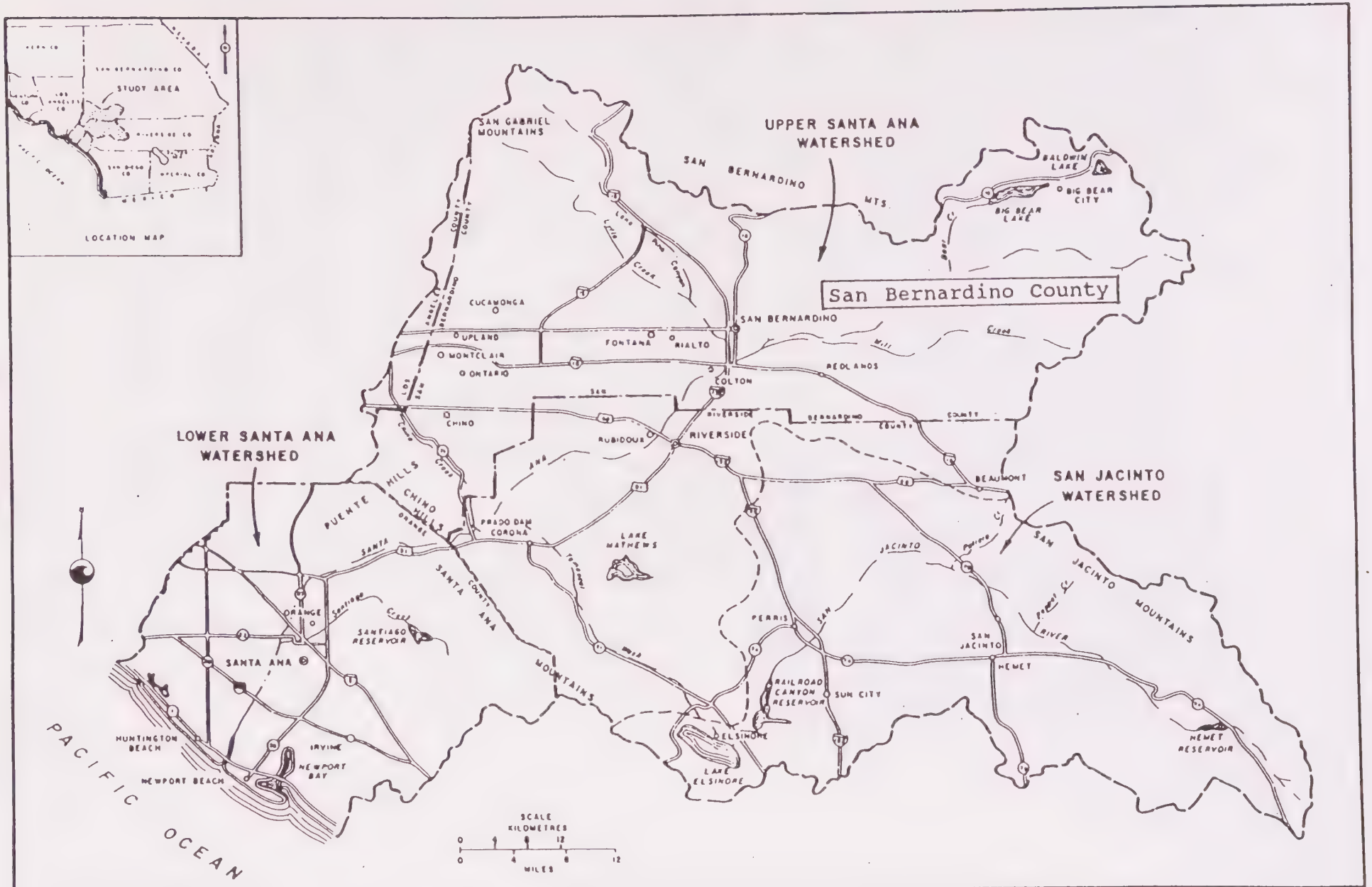
Fig. 4

2. Santa Ana Region

The Santa Ana Region is made up of the watershed of the Santa Ana River, and its tributaries, including the San Jacinto River system. Included within this Region is the southwest corner of San Bernardino County, which covers the entire Valley planning area and approximately half of the San Bernardino and San Gabriel Mountains within the Mountain planning area. All of the cities and communities within the Valley, and the mountain city of Big Bear Lake and the unincorporated communities of Big Bear and Running Springs are included. Also included in the Region is the northwestern portion of Riverside County, the northern half of Orange County, and a very small portion of Los Angeles County. The Santa Ana RWQCB offices are located in the city of Riverside. The Region is indicated in Fig. 5.

Most of San Bernardino County's public wastewater collection/treatment facilities are within the Santa Ana Region. These include:

- Chino Basin Municipal Water District (CBMWD) facilities which serve the cities of Chino, Upland, Montclair, Ontario, Fontana, and Rancho Cucamonga, and the unincorporated community of Chino Hills.
- City of Rialto
- City of Colton
- City of San Bernardino
- City of Redlands
- Yucaipa Valley Water District facilities, serving the unincorporated communities of Yucaipa and Calimesa.
- County Service Area 70 S-3, serving the unincorporated community of Lytle Creek.
- Running Springs County Water District, which serves the unincorporated mountain communities of Running Springs, Snow Valley, Arrowbear, and Green Valley Lake.
- Big Bear Area Regional Wastewater Agency.



THE SANTA ANA REGION

DEPARTMENT [illegible] RESOURCES, SOUTHERN DISTRICT, 1982

3. Lahontan Region

The Lahontan Region is situated in an arid inland basin and includes a substantial portion of the Mojave Desert in the County's North Desert Planning Area, in addition to approximately half of the San Bernardino and San Gabriel Mountains in the County's Mountain planning area. The Victor Valley area, Barstow, and Baker are within the North Desert; the Region also includes the Mountain communities of Wrightwood, Crestline, and Lake Arrowhead. The overall Lahontan Region is the largest in the State and is divided into north and south basins; the south basin contains a large part of San Bernardino County, most of Inyo County, and portions of Los Angeles, Kern and Mono Counties. The Lahontan RWQCB (south basin) offices are located in the city of Victorville. Fig. 6 illustrates the Region.

Public wastewater collection/treatment facilities within the Region are as follows:

- Victor Valley Wastewater Reclamation Authority facilities serving the cities of Adelanto and Victorville, in addition to the unincorporated communities of Apple Valley, Hesperia, Oro Grande, Spring Valley Lake, and George Air Force Base.
- City of Barstow.
- Baker Community Services District.
- County Service Area 70 B, serving the unincorporated community of Helendale.
- County Service Area 82, serving the unincorporated communities of Trona and Pioneer Point.
- Crestline Sanitation District.
- Lake Arrowhead Community Services District.

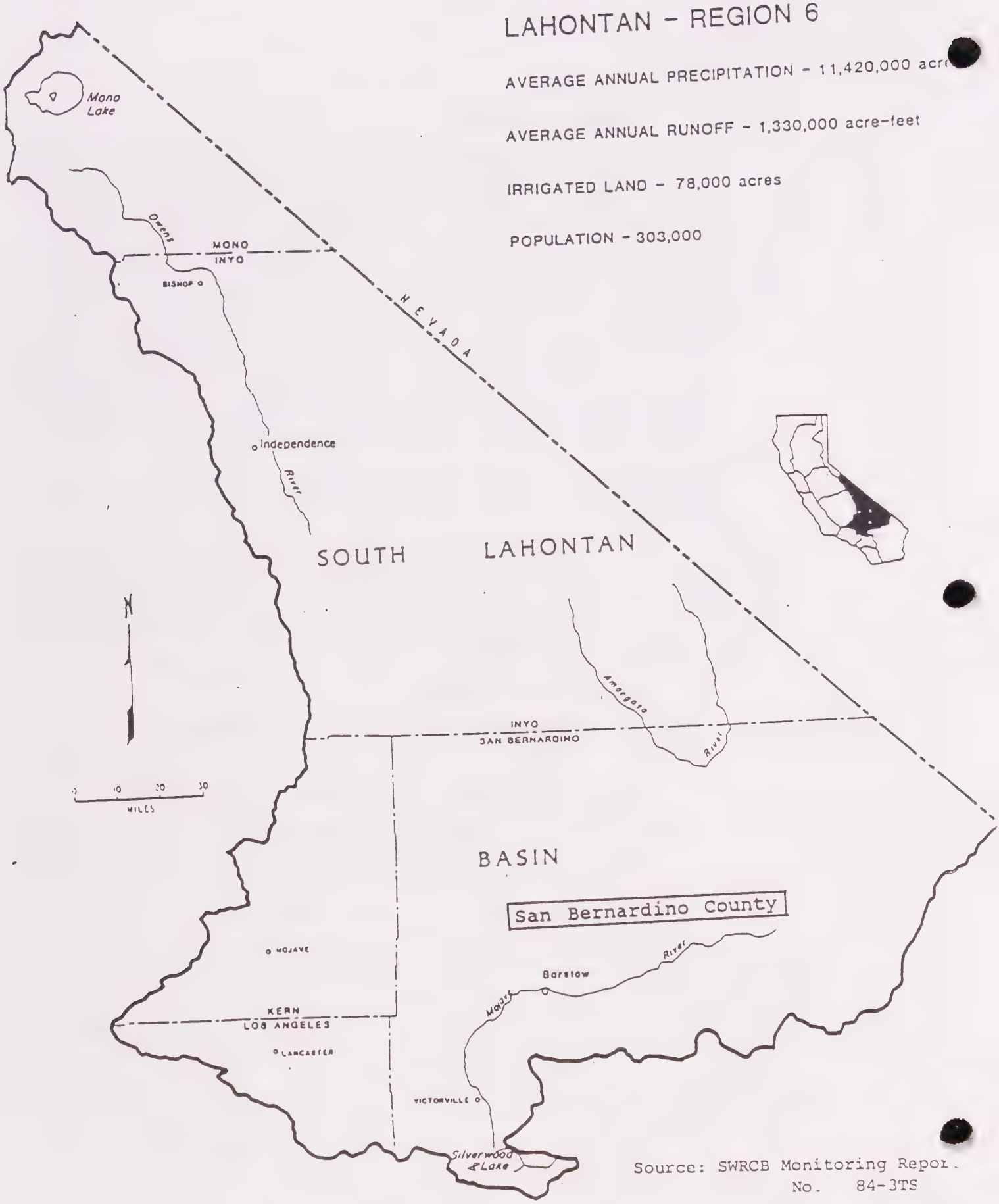
LAHONTAN - REGION 6

AVERAGE ANNUAL PRECIPITATION - 11,420,000 acre

AVERAGE ANNUAL RUNOFF - 1,330,000 acre-feet

IRRIGATED LAND - 78,000 acres

POPULATION - 303,000



Source: SWRCB Monitoring Repor.
No. 84-3TS

Fig. 6

4. Colorado River Region

The Colorado River Region is also situated in an arid inland basin, and includes the County's South Desert planning area and a part of the North Desert planning area. The cities of Needles and Twentynine Palms, and the unincorporated communities of Morongo Valley, Yucca Valley, Joshua Tree, Landers, and all Colorado River communities in San Bernardino County are within this Region. Overall, the Region represents only a small part of the larger Colorado River drainage area. The Region contains a large portion of southeastern San Bernardino County, as well as most of Riverside County, all of Imperial County, and the western part of San Diego County. The Colorado River RWQCB offices are located in the city of Palm Desert in Riverside County. Fig. 7 indicates the extent of the Region.

There is only one public wastewater collection/treatment system in San Bernardino County within the Colorado River Region. The system is operated by the city of Needles in the eastern County on the Colorado River.

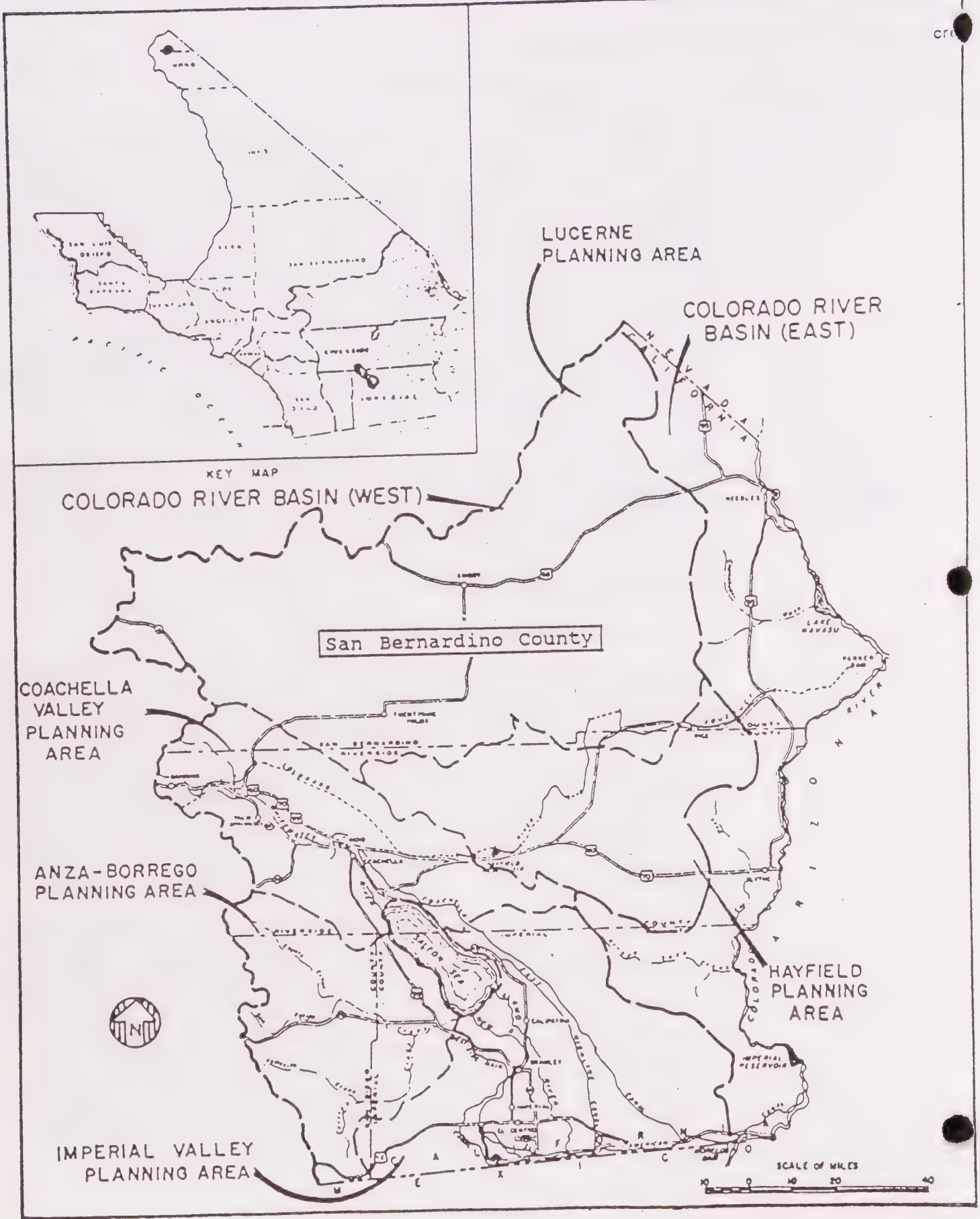
All other areas have no public wastewater collection/-treatment facilities.

5. Waste Discharge Requirements

Permits for waste discharges are granted by the RWQCBs according to their individual requirements after review by staff and the board, which usually holds monthly meetings to determine requirements for each discharge proposal. This process is the principal means of reaching the goals of the water quality control plans and protecting the region's water resources. Waste discharge requirements may make it necessary for dischargers to improve their wastewater treatment systems, relocate their points of discharge, eliminate or modify incoming discharges to their systems, etc.

Two types of permits govern the discharge of waste, Waste Discharge Requirements (WDRs) and National Pollutant Discharge Elimination System (NPDES) permits. WDRs are issued by RWQCBs under the California Water Code, Division 7 (Water Quality), Article 4 (Waste Discharge Requirements). Discharges which are not made to surface waters, but which could have an impact on the underlying groundwater basin are controlled by WDRs. This type of permit is typically issued to publicly-owned treatment works (POTWs) wastewater reclamation projects, non-toxic waste discharges from industrial

COLORADO RIVER BASIN REGION PLANNING AREAS



BA-II-D-16

Fig. 7

operations, significant subsurface waste discharges such as septic tanks, sanitary landfills, dairies, and other projects which could affect water quality.

NPDES permits are also issued by RWQCBs, but are subject to approval by the Environmental Protection Agency (EPA) Regional Administrator in San Francisco, under the Federal Clean Water Act (Public Law 92-500), Title IV (Permits and Licenses), Section 402. Significant discharges to surface waters are covered by this permit process; typical dischargers include publicly owned treatment works (POTWs), industrial cooling water discharges, stormwater runoff and discharges not made to POTW sewer systems, etc. The aim is the reduction or elimination of pollutants in discharges in order to achieve the goal of the Clean Water Act to make all navigable (surface) waters "fishable and swimmable".

6. Wastewater Collection and Treatment Systems: Countywide Perspective

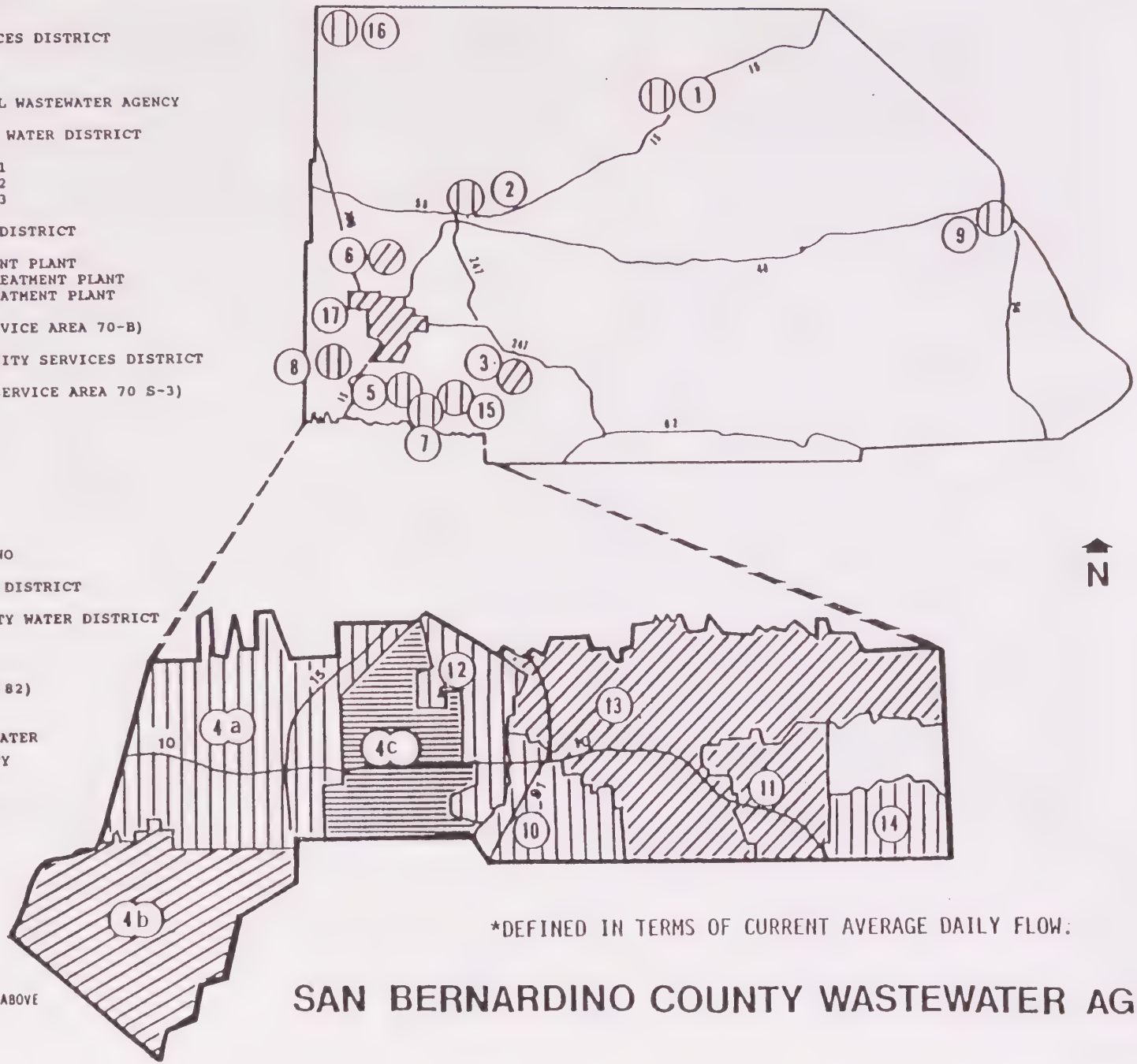
To gain a countywide perspective of public wastewater treatment systems, a recent SCAG report (Infrastructure Capacity Analysis: Wastewater Component, March 1986) which provides a comprehensive inventory and assessment of current and projected future flows and treatment capacity has been utilized as a source document, with additional information included where available. The report focuses on publicly owned municipal treatment plants in the six-county SCAG region.

The State of California Administrative Code requires wastewater districts to commence planning, either for expansion or preventing flow volumes from exceeding available capacity, a full four years prior to full capacity being reached. This replaced a previous requirement for districts to begin planning upon reaching 75% of their capacity. The 75% factor was found to be inconsistent, allowing too little lead time in some cases and too much in others. In the following general assessment of available capacity the 75% factor has been used as a general rule of thumb to indicate that a district is operating critically close to its full capacity when above that figure, and has some availability to provide for growth and heavy peak flows when below 75%.

In San Bernardino County there are a total of 22 public wastewater treatment plants. The general location of the plants service areas is indicated on Fig. 8. The SCAG wastewater capacity analysis identified a total of 19 public wastewater treatment plants in the County

WASTEWATER AGENCIES

1. BAKER COMMUNITY SERVICES DISTRICT
2. CITY OF BARSTOW
3. BIG BEAR AREA REGIONAL WASTEWATER AGENCY
4. CHINO BASIN MUNICIPAL WATER DISTRICT
   - a. REGIONAL PLANT #1
   - b. REGIONAL PLANT #2
   - c. REGIONAL PLANT #3
5. CRESTLINE SANITATION DISTRICT
   - a. CLEGHORN TREATMENT PLANT
   - b. HOUSTON CREEK TREATMENT PLANT
   - c. SEELEY CREEK TREATMENT PLANT
6. HELENDALE (COUNTY SERVICE AREA 70-B)
7. LAKE ARROWHEAD COMMUNITY SERVICES DISTRICT
8. LYTLE CREEK (COUNTY SERVICE AREA 70 S-3)
9. CITY OF NEEDLES
10. CITY OF COLTON
11. CITY OF REDLANDS
12. CITY OF RIALTO
13. CITY OF SAN BERNARDINO
14. YUCAIPA VALLEY WATER DISTRICT
15. RUNNING SPRINGS COUNTY WATER DISTRICT
16. TRONA/PIONEER POINT (COUNTY SERVICE AREA 82)
17. VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY



CAPACITY USE

- CAPACITY USE < 75%
- CAPACITY USE 75%-99%
- CAPACITY USE 100% AND ABOVE

*DEFINED IN TERMS OF CURRENT AVERAGE DAILY FLOW.

SAN BERNARDINO COUNTY WASTEWATER AGENCIES

BA-II-D-18

with a total capacity of 104.2 MGD (million gallons per day). The treatment plants were operating (1986) at 73% of that capacity, with an unused capacity of 28.5 MGD. A further 40.0 MGD was committed (funded capacity not yet under construction). A total of 838,400 persons of the County's total 1985 population of 1,053,800 were served by the treatment plants. Treatment capacity would be inadequate in the year 2000 to meet peak flow demand, however, there would be adequate capacity to serve anticipated average daily flows.

It should be noted that the figures presented in the above paragraph are totals and that variations between districts indicate that certain districts would have adequate capacity for their service areas. It is also noted that additional wastewater treatment facilities have been identified which were omitted from the SCAG study. These are the facilities of Lake Arrowhead Community Services District, and County Service Area 82 serving the communities of Trona and Pioneer Point. Due to the comparatively small size of these facilities, which together serve an estimated population of approximately 12,000 and account for average daily flows of approximately 1.5 MGD, their inclusion in the Countywide analysis has no impact. These facilities will be summarized along with the other wastewater facilities in the next section of this report. Fig. 8 indicates the general location of the public wastewater collection and treatment facilities.

The following table summarizes the information for the 19 wastewater treatment facilities in the above study.

Table 3: Wastewater Treatment Facilities in San Bernardino County 1985/86 (Facts and Figures)

Population Served:	838,400
Total County Population:	1,053,800
Percentage of Population Served:	80%
Current Design Capacity:	104.2 MGD
Current Average Daily Flow:	75.7 MGD
Percentage of Capacity Used:	73%
Current Unused Capacity:	28.5 MGD
Additional Committed Capacity (funded	40 MGD
Population Equivalent of Committed and Unused Capacity	748,700

A look at individual treatment plants indicate that seven districts are experiencing demands of more than 75% on treatment plant design capacities, with many plants requiring upgrading or expansion to keep pace with growth. The City of San Bernardino has been identified as a major potential problem area due to a lack of funding for expansion should the Santa Ana RWQCB require tertiary treatment. Countywide demands on treatment plant capacities in the year 2000 are expected to increase to 83%, with seven districts exceeding 75% of design capacity.

The County's wastewater treatment districts and plants are concentrated in the southwest corner of the County. Most are located in the East and West Valley planning areas, the San Bernardino Mountains, and the Victor Valley area. The largest district, the Chino Basin Municipal Water District (CBMWD), serves the entire West Valley planning area. The East Valley planning area is served primarily by a number of city-operated treatment plants. The Mountain planning area's communities are served by special districts which operate relatively small treatment plants. The Desert planning area is for the most part unserved, with the exception of a regional treatment plant in the Victor Valley, and city operated plants in Barstow and Needles. Special districts also operate small plants in a number of unincorporated desert communities.

A second report prepared by SCAG (Impact Assessment: Draft Baseline Projection, March 1987) states that the SCAG Region as a whole will experience an 18% shortfall in wastewater treatment plant capacity by the year 2010 unless facilities are expanded, based on the difference between projected wastewater flows and existing plant capacity. San Bernardino County was identified as having a much higher shortfall (31%) than the overall region.

Funding has been identified as a critical issue facing both existing and future wastewater capacity needs. The consequences of inadequate funding could constrain the growth that is projected for certain areas, and degrade water quality where wastewater flows are allowed to exceed capacity and where wastewater is inadequately treated.

As more and more wastewater is generated by growth and enters receiving waters, the level of treatment will become increasingly important for maintaining water quality. Currently, the Upper Santa Ana Region which covers the East and West Valley planning areas and part

of the Mountain planning area generally receives secondary treatment of its wastewater at existing treatment plants in the East Valley and Mountains, and tertiary treatment in the West Valley. However, the Santa Ana RWQCB has recommended nitrogen management measures for treatment plants so that discharge would not exceed 10 milligrams per liter; an interim requirement at this level was established by the Santa Ana RWQCB for the incremental (additional) flow over that amount discharged during the summer of 1987. This limit was included in discharge permits for the cities of Redlands and San Bernardino. This would mean additional treatment beyond the present secondary level, thus requiring additional facilities and funding in the East Valley and Mountain areas within the Santa Ana Region. The interim policy is to be reviewed upon completion of a comprehensive nitrogen management study for the Upper Santa Ana River watershed and may result in an adjustment to the total inorganic nitrogen concentration limit established in the Santa Ana RWQCB's interim policy. The present capacity shortfalls mentioned in the earlier paragraph do not reflect the possibility that treatment beyond existing levels may be required. To bring treatment plants up to new standards would show larger inadequacies than indicated.

Another issue is the condition and ability of wastewater collection systems to serve existing and future demands. Some districts, especially in older areas, have deteriorated systems needing rehabilitation or replacement. Also, some systems need enlarging; this occurs even in areas where treatment plant capacity is adequate.

The following sections provide a description of each district's facilities, and current and future needs and capacity by planning area. Most information is based on 1985/86 figures; more recent information is indicated. Information on sewage collection systems (sewers) is provided as available.

7. Wastewater Collection and Treatment Systems: East Valley Planning Area

City of Colton

The Colton treatment plant has a design capacity of 5.4 MGD, and is currently operating at 65% of capacity (3.4 MGD) to serve the city's 20,000 residents. Existing capacity could serve nearly 12,000 more residents. There is likely to be a need for additional capacity within the next 15

years, and the district may go to tertiary treatment in the near future to improve treatment and for an overall increase in capacity. The district is currently having problems with siphons in part of the collection system, and is trying to re-route 1.0 MGD.

Recent contact with the City's Public Works Department indicated that consultants are working on a Master Plan and EIR, which should be ready in 1988.

City of Redlands

The Redlands treatment plant serves the city's population of 42,000 with a design capacity of 6.0 MGD. The plant is currently operating at about 78% of capacity (4.7 MGD) and could serve an additional 12,000 to 15,000 residents. The city expects to need additional capacity by year 2000, and is currently purchasing property for sludge drying beds; it will also be purchasing new clarifiers and a new lift station with a design capacity of 3.0 MGD. There are no critical needs at this time in the district.

A recent update of information in the above paragraph obtained from the City of Redlands indicates that the current design capacity at the plant in Redlands is 6.8 MGD with flows averaging 5.4 MGD. A further expansion to 9.0 MGD is underway with completion scheduled for December 1989.

City of Rialto

The City of Rialto's 6.0 MGD treatment plant is currently operating at 60% of capacity (3.6 MGD) serving the 45,000 residents. The plant's engineers are currently developing plans for plant refabrication and for meeting capacity needs of future growth.

City of San Bernardino

The 216,000 residents of San Bernardino and nearby areas including Loma Linda are served by a 28.0 MGD treatment plant, which is currently operating at about 80-95% (22.5 MGD) of capacity. Two large developments currently under construction (an industrial park and a shopping mall) will take the plant to capacity; construction of a solids facility beginning in August 1989 will provide an

additional 12.0 MGD of capacity by 1989. This project is funded through an EPA grant. The district is negotiating with the Santa Ana RWQCB on whether it is to go to tertiary treatment, which would use funds slated for additional expansion of the plant to serve population growth. If this occurs, the city may need to impose a building moratorium. Total flow by year 2000 is expected to reach 62.0 MGD, with "unconstrained" growth. The above information is taken from the previously mentioned SCAG report of 1986.

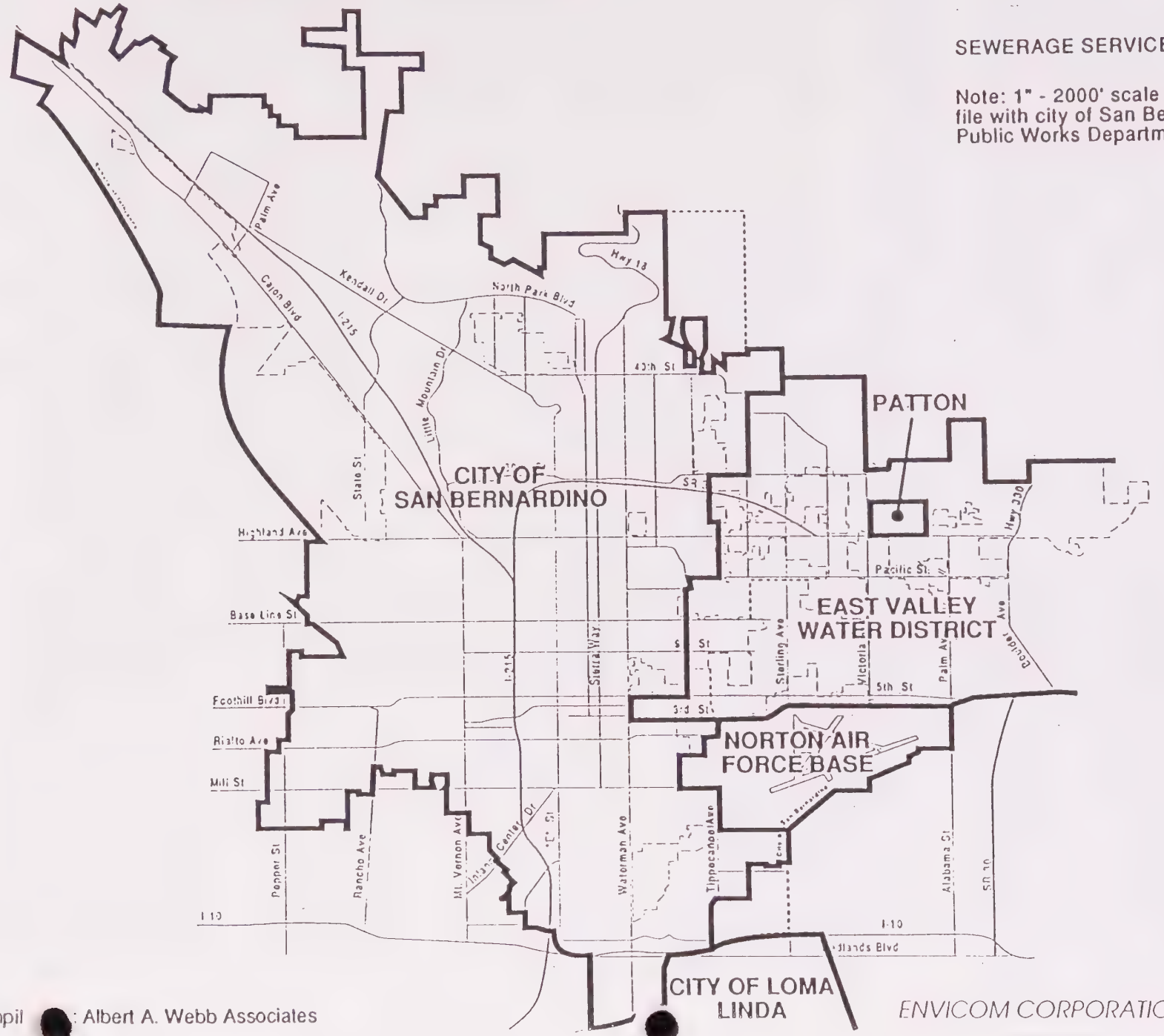
The information in the following paragraphs has been extracted from the City of San Bernardino's General Plan Update Technical Background Report, February 1988.

The San Bernardino Wastewater Treatment Plant (WWTP) is operated by the City of San Bernardino Municipal Water Department and provides treatment of combined domestic and industrial wastewater from the City of San Bernardino, City of Loma Linda, East Valley Water District, Patton State Hospital, and domestic wastewater from Norton Air Force Base. All sewage from these areas flows through the City of San Bernardino's interceptors and wastewater treatment and disposal facilities. The service area boundaries are shown on Fig. 9. The WWTP has a design capacity of 28 million gallons per day (MGD) of primary and secondary treatment capacity, and 3 MGD of tertiary treatment capacity. However, current inflow to the WWTP is approximately 25.5 MGD, or 2.5 MGD less than maximum capacity. As of 1986, the WWTP served over 216,000 residents and various industrial dischargers.

Industrial dischargers represent 3 percent of the total inflow to the WWTP. If current levels of growth continue, total flow is expected to reach 40 MGD by the year 2000. An expansion of the WWTP is in the planning stages. The expansion would add 30 MGD of primary capacity, 15 MGD of secondary capacity, 7.5 MGD of tertiary capacity, and 15 MGD of solids handling facilities. Although the hydraulic capacity of the plant will increase to 58 MGD after the proposed expansion, the discharge capacity will be limited by the secondary capacity of 43 MGD.

SEWERAGE SERVICE AREA BOUNDARIES

Note: 1" - 2000' scale map on file with city of San Bernardino Public Works Department.



Compiled: Albert A. Webb Associates

ENVICOM CORPORATION

Fig. 9

Sewage collection systems for the treatment plant are operated by the city for the majority of the overall planning area. A 1983 "Sewer Main System Update Report" prepared by consultants revealed that the existing sewer mains within the City do not have adequate capacity to carry projected future flows if the service area were developed in accordance with existing land use plans and zoning. These deficiencies are scattered throughout most of the system. The Sewer Main System Update Report also identified the sewer mains that are deficient and need replacement. These mains were given a replacement priority. Other sewer line extensions are proposed to serve new tributary areas and have no assigned priority, and their timing will depend on the area's ultimate development. City and County policies permit septic tanks under certain conditions. Areas with septic tank systems also exist in many locations within the City's service area.

The major septic areas are as follows:

a. Northwest of Little League Drive
b. Other portions of the Verdemont area where parcels are greater than 1 acre
c. Palm Avenue and Industrial Parkway area
d. Cajon Boulevard and June Street area
e. Northwest of I-215/30 Interchange
f. County pockets in the Highland area

The East Valley Water District (EVWD) provides sewage collection service in the eastern portion of the planning area. Sewage collected by EVWD is transported to the City of San Bernardino's Sewage System, and ultimately to the WWTP. EVWD's existing system is generally adequate according to the "Sewage Collection System Master Plan", prepared by Neste, Brudin and Stone, September 1984. However, if all existing lots within the EVWD's boundary are developed with the expected urbanization of the area east of Boulder Avenue, several areas may reach maximum capacity during peak hours and the existing pipelines in the EVWD sewage system and San Bernardino's collection system will be overloaded.

The City of Loma Linda and Norton Air Force Base operate and maintain their own collection systems, but their sewage is treated at the City of San Bernardino's treatment facility. The City of Loma

Linda has two and Norton Air Force Base has one connection to the City's collection system.

Each application for a permit to connect any property with a public sewer has one or more of the following fees:

a. Connection fee for off-site trunk lines and collection facilities. This fee is deposited into the Sewer Line Construction Fund.

b. Connection fee for construction and improvements of the Wastewater Treatment Plant or for additional capacity. These fees are deposited in the Sewer Fund.

c. Connection fee to recover extra administrative costs relating to processing applications for property located outside the corporate limits of the City of San Bernardino and requesting sewerage service from the City. These funds are deposited into the City's General Fund.

d. Connection fee for reimbursement of funds advanced by the Sewer Line Construction Fund or by property owner for sewer line extensions.

Significant issues associated with wastewater collection and treatment systems affecting the planning area include the following:

a. The Regional Water Quality Control Board permits septic systems subject to City or County policies. The City has restrictions on the use of septic tanks, but the County does not.

b. Portions of the sewer system infrastructure require replacement.

c. Funding for sewer system infrastructure improvements is needed.

d. Future development requires sewer system infrastructure as well as service capacity.

Yucaipa Valley Water District

A 3.0 MGD treatment plant to serve the Yucaipa Valley was recently completed by the Yucaipa Valley Water District. The plant is eligible for funding for a 1.5 MGD expansion; part of the funding has already been collected from customers through expansion fees. The plant is intended to serve 25,000 to 28,000 residents of the Yucaipa area, including the communities of Calimesa and Dunlap. The district will have to reserve one MGD of capacity for Dunlap, although no collectors have been installed there and residents may not wish to be connected to the sewer system.

8. Wastewater Collection and Treatment Systems: West Valley Planning Area

Chino Basin Municipal Water District (CBMWD)

The Chino Basin Municipal Water District currently operates three regional treatment plants. Regional Plant #1 (RP#1) serves the cities of Upland, Rancho Cucamonga, Ontario, and Montclair, with a combined population of 262,630. Design capacity of the treatment plant is 29.5 MGD; it is currently operating at 72% of capacity (21.2 MGD), but this will increase to about 85% (24.8 MGD) in 1985/86 when Regional Plant #3 (RP#3), in Fontana, is deactivated and its flows diverted to RP#1. The district plans to expand RP#1 to 32 MGD of hydraulic capacity and 44 MGD of solids handling capacity in 1986/87, and to 44 MGD of hydraulic capacity in 1995/96. The district also plans to construct a 7.5 MGD wastewater reclamation facility in the RP#1 service area by around 1990. The funding source for these improvements are a combination of ad valorem taxes and connection fee revenue. The highest priority need for the RP#1 service area, beyond the planned expansion, is for additional interceptor system capacity; the Cucamonga, Montclair, and Upland Interceptors, in particular, are nearing capacity and are scheduled for expansion under the district's Capital Facilities Expansion Program.

Regional Plant #2 (RP#2), which serves a population of 62,590 in the Chino area, has a design capacity of 6.7 MGD, and is currently operating at about 94% of capacity (6.33 MGD). However, 2.5 MGD of the 6.33 MGD flow generated in the RP#2 service area comprises highly saline domestic wastes

(which cannot be brought to water quality levels required by the discharger permit); this flow is diverted into the Santa Ana River Interceptor (SARI line) for treatment at the Orange County Sanitation District. With this SARI diversion, the plant is actually operating at only 57% of capacity. Current facility planning calls for the expansion of RP#2 by 5 MGD or the construction of a second regional plant with an initial capacity of 5 MGD in the RP#2 service area by 1990. Funding would be a combination of ad valorem taxes and connection fee revenues. There is a potential for a capacity shortfall in one of the two interceptors that transport wastewater to RP#2, if the existing facility is expanded; in this case, the Chino Interceptor would quickly require paralleling. If a new treatment facility is constructed, however, no additional interceptor would be required until the 1990s.

The 3.5 MGD Regional Plant #3 (RP#3), which serves Fontana's population of 50,3000, is scheduled for temporary deactivation during 1985/86, with flows to be treated at RP#1. The plant is currently operating at more than 100% capacity (3.62 MGD). On deactivation of RP#3, flows will be transported to RP#1 via the recently constructed Fontana Interceptor. RP#3 may be kept in operation for treatment of one MGD for agricultural reuse, and the district plans to reactivate the plant when the Fontana Interceptor reaches capacity in the mid-1990s.

The information in the following paragraphs on CBMWD is from recent contacts (late 1987 and January 1988) with the District, and when compared with the above data, reflects the rapid rate of change in less than two years.

CBMWD is a regional water and wastewater agency serving virtually all of the County's West Valley planning area. A regional sewerage contract in 1972 provided for CBMWD to buy out city treatment plants and to act as a regional wastewater agency. Each contracting city or agency submits an annual report including a 10 year forecast for their areas, which CBMWD uses to produce a 10 year Capital Improvement Program (CIP) for the overall area. Fig. 10 indicates the CBMWD service area, along with existing and proposed wastewater treatment plants.

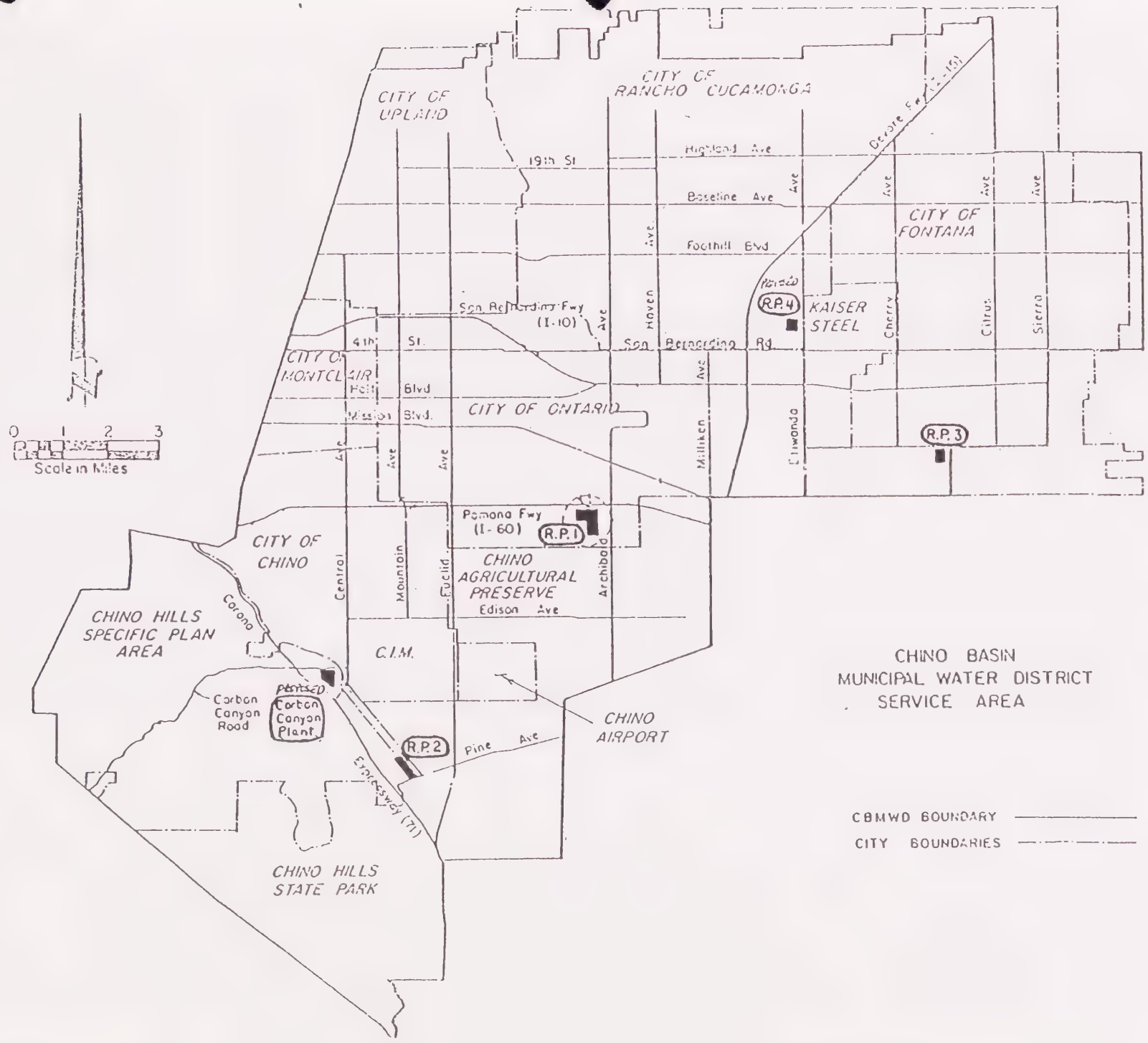

CITY OF UPLAND
CITY OF RANCHO CUCAMONGA
CITY OF FONTANA
CITY OF MONTCLAIR
CITY OF ONTARIO
CITY OF CHINO
CHINO AGRICULTURAL PRESERVE
CHINO HILLS SPECIFIC PLAN AREA
CHINO HILLS STATE PARK
CHINO AIRPORT
C.I.M.
KAISER STEEL
Proposed R.P.4
R.P.1
R.P.2
R.P.3
Proposed Carbon Canyon Plant
Carbon Canyon Road
Pomona Fwy (I-60)
San Bernardino Fwy (I-10)
Foothill Blvd
Baseline Ave
Highland Ave
19th St
4th St
Mission Blvd
Edison Ave
San Bernardino Rd
Pine Ave
Central Ave
Mountain Ave
Euclid Ave
Archibald Ave
Haven Ave
Cherry Ave
Citrus Ave
Sierra Ave
Etiwanda Ave
Millliken Ave
Corona Expressway (71)
Scale in Miles
0 1 2 3
CHINO BASIN MUNICIPAL WATER DISTRICT SERVICE AREA
CBMWD BOUNDARY
CITY BOUNDARIES

Fig. 10

There are two service areas for wastewater collection and treatment in the CBMWD. The Regional Plant No. 1 (RP#1) service area includes the cities of Upland, Rancho Cucamonga, Ontario, Montclair, and Fontana; this area is served by RP#1 in Ontario, RP#3 in south Fontana, and a proposed RP#4 in southeast Rancho Cucamonga which is scheduled to be completed in 1993. The RP#2 service area serves the city of Chino and the unincorporated Chino Hills; this area is at present served by the existing RP#2, and a proposed Carbon Canyon treatment plant is scheduled to be completed in 1991 with flows from Upland and Montclair to be diverted from the RP#1 to this new facility.

The current CIP 86/87 - 96/97 envisions the expenditure of approximately $172 million during the ten-year period to keep pace with growth. Wastewater flows in the RP#1 service area system, which includes the existing RP#1, existing RP#3, and the proposed RP#4 in southeast Rancho Cucamonga, could increase to 48 MGD by the end of fiscal year 96/97, representing an increase of over 20 MGD from the 86/87 annual average flow of approximately 28 MGD. RP#1 is to be expanded from its current capacity of 32 MGD to 44 MGD by early 1990. RP#3 is now de-activated and being used as a solids separation facility with no discharge of effluent; liquids are being conveyed to RP#1 via the Fontana interceptor. A master plan is being prepared for a new 8 MGD RP#3 water reclamation plant with completion anticipated just beyond the horizon of the 10 year CIP in the late 1990's. The proposed RP#4 will have 7.5 MGD capacity and is scheduled for completion in 1993.

These facilities, when completed, will have combined capacity of 59.5 MGD in the late 1990's compared to projected flows of 48 MGD in 96/97, resulting in an excess capacity of over 11 MGD.

The RP#2 service area is expected to generate flows approaching 8.5 MGD in 88/89 and reaching 11.5 MGD in 96/97. A new treatment plant (Carbon Canyon Plant) with an initial capacity of 10.2 MGD is expected to be completed in mid-1991. The existing RP#2 has a capacity of 6.7 MGD, with no additional capacity planned. Until the Carbon Canyon Plant is completed, service area flows exceeding 6.7 MGD will be diverted to the SARI (Santa Ana Regional Interceptor) System. The SARI line is a pipeline

facility designed to carry unusable wastewater, primarily from industrial and agricultural uses, to a treatment plant in Orange County, and is operated by the Santa Ana Watershed Project Authority (SAWPA). The activities of this regional agency will be covered in another section of this report. The wastewater treatment facilities in the RP#2 service area will have a combined capacity of 16.9 MGD in 1991. Projected flows totaling 13.5 MGD to the two treatment plants are projected as follows for 96/97:

Carbon Canyon Plant..... 6.55 MGD flow
(includes 2 MGD diversion flows from Upland and Montclair from RP#1 service area)

RP#2 ..... 6.95 MGD flow

Total 13.50 MGD flow

It can therefore be anticipated that the combined capacity of the two RP#2 service area plants of 16.9 MGD will result in an excess capacity of 3.4 MGD with projected flows of 13.5 MGD. For planning purposes the District uses a standard generation factor of 270 gallons per day per equivalent dwelling unit (EDU).

Lytle Creek County Wastewater District-County Service Area 70S-3

The Board of Supervisors runs this mountain area treatment district, which is located in the West Valley Planning area. The Lytle Creek plant has a capacity of 0.161 MGD, and operates at 39% of capacity under normal conditions (0.062 MGD) and 54% under peak conditions (0.087 MGD). There are 640 permanent residents in the plant's service area, and a maximum of 200 campers in campgrounds. The district does not expect to require additional treatment capacity unless property is re-zoned to allow development of additional residential units. The highest priority need for the district is financing.

9. Wastewater Collection and Treatment Systems: Mountain Planning Area

Big Bear Area Regional Wastewater Agency

The Big Bear treatment plant is challenged by high peak flows accompanying the influx of skiers and

other weekend holiday visitors throughout the year. There are about 13,000 permanent residents served by the sewer district and as many as 48,000 overnight visitors during holiday weekends (as well as a larger number of 1-day visitors--totals are as high as 100,000 persons). The plant can handle an average of 3.2 MGD, although the weekday non-holiday flow is much lower (about 1.7 MGD or 78% of capacity) and peak flows during holidays/ski season can run as high as 5.0 MGD. The district is currently constructing $5.8 million in improvements to accommodate the amount of infiltration and inflow into the area's 40-year old pipes, which has created hydraulic problems in the treatment plant; these improvements will not create any additional treatment capacity (except during emergency conditions, when the plant will be able to hydraulically handle 9.0 MGD), but will allow better utilization of the capacity that already exists. A permanent resident population of 20,000 is expected by 2000; when this level of population is reached, the plant's treatment capacity will require expansion. The highest priority needs at the plant are facilities for handling the peak flows, and managing the infiltration and inflow problems; improvements to correct these problems are currently under construction.

Crestline Sanitation District

The Crestline Sanitation District, a special district of the San Bernardino County Board of Supervisors, operates three small treatment plants --with a combined treatment capacity of 1.4 MGD- near lake Silverwood in the San Bernardino National Forest. These include the Cleghorn Treatment Plant with a capacity of 0.2 MGD (currently operating at 15% of capacity, or 0.030 MGD), the Houston Creek Treatment Plant, 0.7 MGD (41% of capacity, or 0.29 MGD), and the Seely Creek Treatment Plant, 0.5 MGD (36% of capacity, 0.179 MGD; 0.2 MGD of the total capacity is currently under construction). (These flow volumes do not account for inflow and infiltration into the collection system.) The three plants serve a total permanent resident population of 7,000 in addition to a seasonal population of up to 20,000. The district can handle an additional population of 8,378 based on available connections. Highest priority needs for the district include: (1) upgrade or replacement of 25% of the collection

system to correct existing high rates of infiltration; and (2) effluent and solids disposal. The district is currently planning to spend $845,000 for collection system rehabilitation under an EPA grant, and in 1985-86 a facility plant will be completed for the district's effluent and solids disposal sites, which has $30,000 in district funding.

The following information was supplied by the District in February, 1988, and updates the data in the previous paragraph.

In recent years the District has increased in area and facilities. The District boundaries run east from Saw Pit Canyon to Twin Peaks, and north from Rim of the World (Highway 18) to Mile High Park, approximately 23,000 acres. The District operates and maintains three treatment plants, 90 miles of collection system, a 14 mile effluent outfall line, and an effluent disposal site on Las Flores Ranch in Summit Valley. Waste solids are hauled to a class 1 dump, north of Victorville.

The District at present serves approximately 4,250 residential and commercial connections. The existing system has the potential of serving 6,500 connections. Approximately one third of the District area is sewered. The unsewered area is comprised of subdivided tracts, government land and large undeveloped parcels. In these areas subsurface disposal systems (septic tanks) are used for sewage treatment and disposal.

The District collection system has two pumping stations, one on the east bank of Lake Gregory, and one on the west bank. The stations pump raw sewage from areas lower than the Houston Creek Treatment Plant up to the main interceptor (pipeline) running to the Houston Creek Plant. The stations are an important part of the collection system. The pumps, stand-by power equipment and other related equipment are checked daily for normal operation. The stations have high water level and power failure alarm systems that send a signal to the District Office. The alarm system is monitored 24 hours a day. The system markedly reduces the chances of a raw sewage overflow into Lake Gregory.

The Houston Creek Plant is a secondary treatment plant consisting of grit removal, comminution,

primary clarification, fixed nozzle standard rate trickling filter, secondary clarification and chlorine disinfection. The plant is designed for a daily flow of .7 MGD. The average daily flow is currently .405 MGD. The treatment plant is manned eight hours per day, seven days per week, year round. The plant is located north of Lake Gregory and serves the largest area; upper Crestline, Gregory Village and San Moritz.

The Seeley Creek Plant was recently (1986) modified and expanded from .2 MGD to .5 MGD design capacity. Seeley is classified as a secondary treatment plant and process units consist of flow equalization, comminution, primary sludge holding tank, standard rate trickling filter, secondary clarification, recirculation pump station and chlorine disinfection. The current daily flow is .3 MGD. In the event of a power outage a 250 KW stand-by generator is used to operate the plant. The Seeley Creek Plant also has an emergency storage pond with a capacity of .4 MGD. The plant is manned eight hours a day, 7 days a week, year round. The Seeley Plant is located north of Camp Seeley on U.S. Forest Service land and serves part of upper Crestline and the Valley of Enchantment.

The Cleghorn treatment plant has a secondary treatment process referred to as an oxidation ditch. The process is a variation of the activated sludge process. The plant units consist of comminution, oxidation ditch, secondary clarification, chlorine disinfection, effluent pumps and force main. This plant is equipped with a 250 KW stand-by power plant. The plant design flow is .2 MGD. At present the daily flows range from .01 MGD to .1 MGD. The flow variations are due to the seasonal use of the Silverwood Lake Facilities. The plant is manned from two to eight hours per day, seven days per week, year round. It is located west of Silverwood Lake just off Highway 138 in the Cleghorn Canyon area. The plant serves the Silverwood Lake administration and maintenance buildings and all other Lake facilities.

The most critical at all three plants is the trickling filters at Houston Creek and Seeley Creek and the oxidation ditch at Cleghorn. These processes are actually biological reactors and in fact are made up of millions of aerobic micro-organisms. The organisms metabolize (feed on) the waste products in the wastewater. The byproduct

of this action are air and water. The processes are very sensitive to changing conditions and therefore require close monitoring in regards to growth rates, to organic loading (feeding rate) and oxygen uptake and transfer.

Recently (1986) the District constructed a beltpress facility at the Houston Creek Plant site. This process through a series of rollers and a large woven plastic perforated belt, squeezes the water out of the waste solids. A 3,000 gallon load of wet solids, which equates to 22,440 cubic feet, is pressed to a volume of 18 cubic feet (26.4% dry solids). This reduction results in fewer trips to the Victorville Landfill. The dry solids are hauled from the Houston Plant to the Landfill (one load per week) in a 10 cubic yard dump truck. The waste solids produced at the Seeley and Cleghorn Plants are hauled in a 3,000 gallon tank truck to the Houston Creek site for dewatering.

The District effluent outfall system runs from Houston Creek Plant down Miller Canyon to the 4,000 foot road where it joins with the outfall line from Seeley Creek Plant. It runs along Highway 138 to Silverwood lake, across Cleghorn Creek where the Cleghorn Plant ties into the outfall. The line then runs into Summit Valley, across Las Flores Ranch and terminates at the District effluent disposal site just below Silverwood Lake Dam. The outfall is a gravity flow line and has 22 air vacuum relief valves installed on it. These valves and the outfall are inspected on a monthly basis. The overall length of the outfall system is approximately 14 miles. Outfall size ranges from 12 inches to 20 inches in diameter.

All disinfected (chlorinated) effluent from the outfall are discharged onto District owned land and Las Flores Ranch land in one of two methods or a combination of both:

1. The effluent is used for flood irrigation of sudan and other wild grasses on the ranch.

2. The effluent may be discharged onto alternating slow sand filter beds operated by the District.

The effluent discharged on the site is routinely sampled and tested. There are eight (8) groundwater monitoring wells on the site, four (4) adjacent to

the irrigation site and four (4) adjacent to the sand filter site. Groundwater from these wells, depending on the discharge method, is also routinely sampled and tested. All the test results, along with the other required treatment plant data, are reported to the Lahontan RQWCB on a monthly basis.

Lake Arrowhead Community Services District

The Lake Arrowhead Community Services District is a self-governed special district serving the communities surrounding Lake Arrowhead, including the Lake Arrowhead Village area, Cedar Glen, Blue Jay, Grass Valley, and Rimforest. The SCAG 1986 report dues not mention this agency; the following information was obtained from the agency's 1983 Wastewater Master Plan and from direct contact with the General Manager.

The existing treatment plant was originally constructed in 1954 and has been modified and expanded several times. At present it provides secondary treatment and disinfection of wastewater at an average day rated capacity of 1.7 MGD. The average day flow is approximately 1.3 MGD.

After secondary treatment at the treatment plant, wastewater is transported 10 miles via an outfall line to a 200 acre "farm" for final treatment and disposal. The farm is located on the west bank of the Mojave River, approximately two miles downstream of the Mojave River Dam and four miles southeast of Hesperia. After final treatment the effluent is used for alfalfa irrigation at the farm.

A new wastewater treatment plant was completed in May of 1988 and is located in Grass Valley near Deer Lodge Park. The new facility has a capacity of 5.0 MGD and utilizes a trickling filter process for secondary treatment. It is unclear at this time whether the existing plant will continue to operate or will be phased out.

The District's 1983 Master Plan identifies numerous problems and deficiencies in the existing sewage collection system. Five major areas within the District were unsewered at that time, but it was assumed that virtually the entire population would be sewered by the year 2005.

Running Springs County Water District

The Running Springs Water Pollution Control Plant serves the San Bernardino National Forest communities of Running Springs, Snow Valley, and Arrowbear. The area has a population of about 15,000 people, which can double on busy weekends during the ski season. The plant normally runs at about 50 to 60% of capacity (0.6 MGD), with higher weekend peak flows. The district has scheduled an expansion for 1992, however population projections have not been realized and expansion will probably be delayed. The highest priority need for the district is improved sludge handling.

10. Wastewater Collection and Treatment Systems: North Desert Planning Area

Baker Community Services District

This small Mojave Desert community of about 500 persons is served by evaporation ponds, rather than a full wastewater treatment plant. There are also about 2.5 million stopovers per year by travelers along I-15, but no need for additional treatment facilities is foreseen by the year 2000.

City of Barstow

The 4.5 MGD water reclamation plant currently serves a population of 22,000 and is only at 49% of capacity (2.2 MGD). On weekends and holidays, approximately 30,000 I-15 stopovers use the waste facilities. At this time, the plant receives an additional 1.0 MGD. With expansion and installation of new pumps, the water reclamation plant will be expanded to 8.0 MGD by 1990; an additional 2.0 MGD expansion is programmed by 2000, the plant is expected to serve an additional 15,000 people by 1990, and with planned expansions will have adequate capacity through year 2000. The city is now building a new seven-mile sewer trunk line to serve the plant.

Helendale--County Service Area 70B

The Helendale treatment plant is another Board of Supervisor's special district, serving 2,200 people in this Mojave Desert community north of Victorville. The plant has a capacity of 0.25 MGD, and is operating at 88% (0.22 MGD) of capacity. The district plans to add 0.25 MGD capacity by

1995, which will be sufficient to serve the population through year 2000. Plant rehabilitation is the highest priority need for the district.

Trona/Pioneer Point-County Service Area 82

Trona and Pioneer Point are served by Improvement Zones 3 and 4, respectively, the Searles Valley Wastewater Project of County Service Area 82. The SCAG 1986 report does not mention this agency. The following information was obtained from direct contact with the agency. Both Improvement Zones have community septic tanks providing primary wastewater treatment, with subsurface discharge into Searles Lake. Improvement Zone 3 (Trona) has approximately 350 connections and is served by septic tanks totaling 102,000 gallons: 90,000 gallons for Trona Village and an additional 12,000 gallons for the elementary, Jr. High and High Schools.

Improvement Zone 4 (Pioneer Point) has approximately 310 connections and is served by septic tanks totaling 105,000 gallons: 75,000 gallons for Pioneer Point North and 30,000 gallons for Pioneer Point South. Both Trona and Pioneer Point are showing a reduction in population and at present there is no new construction taking place in the area.

Victor Valley Wastewater Reclamation Authority

The area served by the Victor Valley Wastewater Reclamation Authority includes Victorville, Adelanto, Apple Valley, Hesperia, the unincorporated areas of Oro Grande and Spring Valley, as well as George Air Force Base. The population served is approximately 50,000, and the 4.8 MGD treatment plant is operating at about 77% of capacity (3.7 MGD). (Part of the service area is still on septic tanks.) The district is starting design on a 1.5 MGD expansion, which will be constructed during the next 4 or 5 years using funds collected as connection fees. The district expects a total demand of approximately 6.5 MGD, but this could go higher if more of the service area is sewered. The slow rate of sewer hookups for the outlying communities (other than Victorville) has created a problem with the district's EPA grants.

The information in the following paragraphs was obtained from direct contact with the Victor Valley Wastewater Reclamation Authority.

The Victor Valley Wastewater Reclamation Authority (VVWRA) provides regional wastewater treatment for the Victor Valley area including the cities of Adelanto and Victorville and the unincorporated communities of Apple Valley, Hesperia, Oro Grande, and Spring Valley Lake, as well as George Air Force Base.

The 4.8 MGD treatment plant, which started up in December of 1981, provides advanced secondary wastewater treatment. Treated effluent is currently discharged to both an area adjacent to the Mojave River and to percolation ponds, thus replenishing portions of the Mojave River.underground water basin. The plant is required to meet State reclamation standards, thus treated effluent approaches drinking water quality. The first expansion should be completed by early summer 1989, and it will bring plant treatment capacity up to about 8 MGD.

There are 27 miles of large interceptor sewers. A VVWRA interceptor sewer connects each community to the regional system. However, the internal collection system within each entity is locally owned, operated and maintained by agencies in the cities/communities mentioned above.

Federal and state regulations require that the plant restrict certain discharges to the sewer system that would adversely affect the operation of the plant and its employees. The VVWRA has defined these restrictions in the Sewer Use Ordinance along with penalties for non-compliance. In addition, new commercial and industrial customers may be required to fill out a pretreatment questionnaire to describe their discharge and help determine the need for preliminary treatment prior to connection to the system.

As a regional agency, VVWRA is committed to responsibly providing treatment services for the Victor Valley. A master plan outlining treatment facility needs over the next 20 years should be completed by mid-1988. Where practical, the agency encourages reuse of treated effluent and other waste by-products. Wastewater flows are expected to steadily increase from the 1987 total

of 4.3 MGD to over 20 MGD by the year 2010. Fig 11 illustrates the projected flows within the VVWRA service area.

A draft Executive Summary dated February 25, 1988, of the Master Plan which is currently being prepared indicates that three scenarios have been developed, each of which is designed to handle all of the projected flows through the year 2010. Scenario one, the All Interceptor Scenario, proposes to construct new interceptors and to parallel deficiencies in the existing system in order to channel all of the flow to one central location. Scenario two, the Sub-Regional Plant Scenario, proposes to construct two new treatment plants, one in Apple Valley and one in West Victor Valley to treat the sewage closer to the source and reduce the need for interceptors as well as needed capacity at the main plant. Scenario three, the Interceptor/Apple Valley Sub-Regional Plant Scenario, is a combination of both the previous scenarios designed to optimize the advantages of each; a Sub-Regional Plant would be constructed in Apple Valley to handle the excess flow beyond the capacity of the existing line and an interceptor would be constructed from the Golden Triangle (Highway 395, I-15, Bear Valley Cut-off area) to the main treatment plant. A total cost summary is as follows:

Scenario 1:	All Interceptor	$63,113,600
Scenario 2:	Sub-Regional Plants in Apple Valley & West Victor Valley	$62,496,000
Scenario 1:	Interceptor/Apple Valley Sub-Regional Plant	$62,516,000

Wastewater collection and treatment facilities, along with other public services, were examined in the Victor Valley area as part of the County's Victor Valley Infrastructure Enhancement Program (VVIEP). This program studied growth and the provision of public services in the area in order to develop a comprehensive approach to accommodating future growth with the necessary urban services. There are two recent reports from the VVIEP which discuss existing conditions and trends in the area's wastewater collection and treatment facilities; these reports are the Preliminary Facilities Inventory and Standards Report by NBS/Lowry, consultants, December 1987, and the draft Division 2 VVIEP Report, Feb. 1988 prepared

PROJECTED FLOW CHART
TOTAL FLOW (MGD)

VVWRA 1-7-87

AGENCY	1987	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010
ADELANTO	0.086	0.127	0.150	0.182	0.221	0.271	0.332	0.406	0.419	0.446	0.473	0.514
APPLE VALLEY	0.388	1.318	1.544	1.691	1.922	2.183	2.489	2.843	2.930	3.112	3.294	3.567
GEORGE AFB	0.770	0.770	0.770	0.770	0.770	0.770	0.770	0.770	0.770	0.770	0.770	0.770
GOLDEN TRI.	0	0	0.174	0.484	0.950	1.581	2.341	3.278	3.494	3.654	3.886	4.058
HESPERIA	0.216	0.441	0.596	0.867	1.217	1.684	2.280	3.028	3.116	3.294	3.472	3.739
ORO GRANDE	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070
SPRING VALLEY	0.391	0.530	0.602	0.674	0.746	0.819	0.889	0.963	0.998	1.070	1.142	1.250
VICTORVILLE	2.430	3.254	3.524	3.788	4.056	4.487	4.809	5.142	5.380	5.698	6.081	6.450
TOTAL	4.256	6.510	7.430	8.526	9.952	11.865	13.980	16.505	17.178	18.109	19.188	20.719

Fig. 11

PRELIMINARY

by County planning staff. The NBS/Lowry report establishes service level criteria for average daily wastewater flows of 100 gals. per capita per day (gpcd) for residential uses and 1,500 gals. per acre per day (gpad) for commercial and industrial uses in the VVIEP area. The aforementioned reports were incorporated in the VVIEP Phase II Final Report in November, 1988.

Direct contacts by County General Plan Team staff with the VVWRA and each of the agencies operating the wastewater collection systems shows that the total flows in late 1987 were as indicated in Table 4 below.

TABLE 4. VVWRA Wastewater Flows 1987

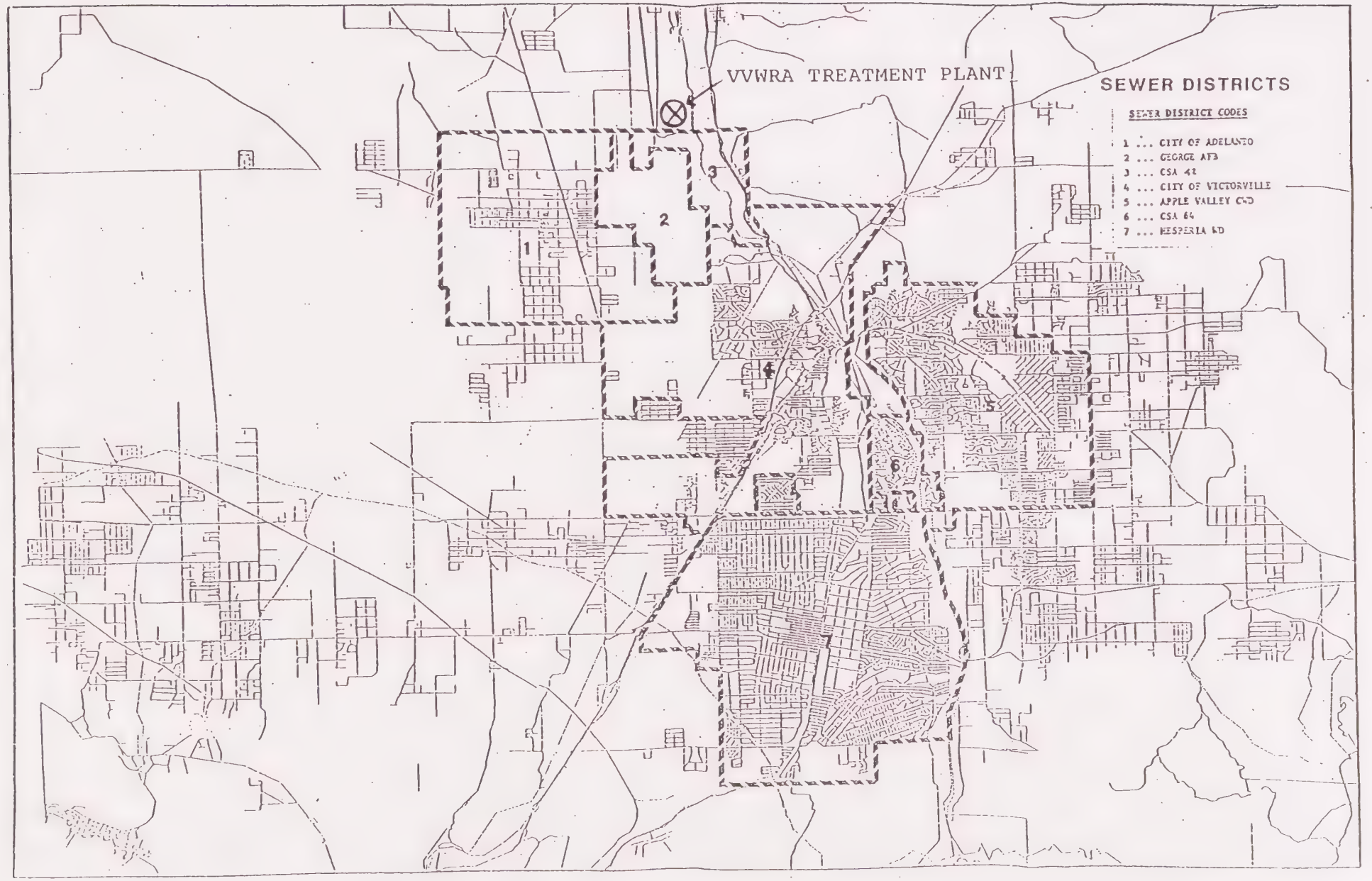
Agency	Average Daily Flows (MGD)	% of Total Flow
Adelanto, City of	0.08	2%
Apple Valley County Water District	0.402	9%
CSA 42 (Oro Grande)	0.065	1%
CSA 64 (Spring Valley Lake)	0.35	8%
George Air Force Base	0.62	15%
Hesperia Water District	0.25	6%
Victorville, City of	2.50	59%
Total influent at VVWRA Plant	4.267	100%

The above table indicates that over half the wastewater at the VVWRA treatment plant originates from the City of Victorville. The unincorporated communities of Apple Valley, Hesperia, Oro Grande, and Silver Lakes account for a combined total of 24% of the total flow. Fig. 12 indicates the VVWRA service area and sewer districts.

11. Wastewater Collection and Treatment Systems: South Desert Planning Area

City of Needles

The City of Needles Wastewater Treatment Plant serves a population of 4,550. The treatment plant is operating at 65% of its 0.8 MGD capacity (0.52 MGD); although the plant is designed for 1.8 MGD, rehabilitation is needed to bring it up to its full capacity. With rehabilitation, the plant will have adequate capacity to serve the expected year 2000 population of 6,900. The highest



VVWRA Service Area

Fig. 12

priorities currently facing the district include: (1) overall financing for treatment plant upgrade and rehabilitation; (2) sludge handling; and (3) completion of the outfall line and de-chlorination station (Completed 1988). Some of the sewer mains and lift station in the older part of town are approaching capacity.

Recent contact with the city's Public Works Department has indicated that a wastewater master plan is being prepared by consultants at this time, and that the wastewater treatment plant now serves a population of 5,200 (1988).

12. San Bernardino County Department of Environmental Health Services (DEHS)

The County's DEHS has a key role in relation to the wastewater issue. DEHS's role is primarily in the regulation of small scale on-site wastewater treatment and disposal systems, such as package treatment plants and on-site septic tank disposal systems. Through memorandums of understanding (MOUs) with the RWQCBs, DEHS establishes guidelines, regulations, standards, etc. to meet objectives of groundwater protection set forth in the RWQCBs Water Quality Control Plans, or Basin Plans. The functions of DEHS which relate to the wastewater issue are described in the following paragraphs.

Septic Systems

The criteria for, as well as the design, installation and management of septic systems is regulated by DEHS, Building and Safety, and the RWQCBs. Minimum distances to ground and surface water are prescribed, and percolation and system design standard are adhered to. Prohibiting septic systems in designated areas of the County has been mandated by the Regional Board when it was determined a potential for water quality degradation was possible or imminent. The County currently has MOUs, as mentioned above, with the Santa Ana and Lahontan RWQCBs regarding subsurface disposal systems.

Under the MOU with the Santa Ana RWQCB the following criteria sets forth specific projects that will not significantly impact water quality and would be permissible for individual disposal systems (septic systems) without a full report of water discharge to the RWQCB:

1. The onsite soil characteristics comply with the established "Minimum Criteria for Subsurface Discharge of Domestic Waste" (Section III).

2. The discharge is composed of only domestic wastes.

3. All residential lots are greater than 20,000 square feet net area, or developments with lots less than 20,000 square feet contain not more than 30 dwelling units.

4. The discharge from commercial developments will not exceed 5,000 gallons per day.

The MOU with the Lahontan RWQCB is in the process of revision and may soon be adopted. Under the current MOU with the Lahontan RWQCB the County is authorized to issue construction permits for projects with individual disposal systems without RWQCB approval under the following conditions:

1. The on-site soil characteristics comply with the established "minimum criteria for subsurface discharge of sewage" (Resolution 74-7, Section IV); and

2. The discharge is composed of <u>domestic</u> wastewater only; and

3. (a) The development density does not exceed two equivalent dwelling units (EDU) per acre (500 gallon/acre/day wastewater flow) or (b) the development consists only of a single family home on an individual lot which (1) has a minimum net area of 15,000 square feet and (2) resulted from a subdivision which occurred prior to the effective date of this Memorandum of Understanding; and

4. The total project does not exceed 30 (thirty) EDU (7500 gallon/acre/day); or

5. The project is in a class which has been designated exempt from Regional Board review in writing under signature of the Regional Board Executive Officer.

The County at present has no MOU with the Colorado River RWQCB.

RWQCBs, as entrusted with water quality protection, have directed discharge requirements and minimum criteria for subsurface sewage disposal systems based on studies that indicate septic tank effluent adds nitrates to the groundwater. The most recent and notable action taken by the Lahontan Regional Board in regards to nitrates was the adoption in January, 1988, of a basin plan amendment in which on-site sewage disposal systems were restricted to a density of two equivalent dwelling units per acre, or a discharge of 500 gallons/acre/day. Simply stated for residential purpose only, a minimum lot size of one-half acre is required for each new house. DEHS, as the County's local enforcement agency in this matter, is in the process of negotiating a revised MOU with the Lahontan Regional Board to implement the adopted amendment. As an adjunct to the amendment, the Regional Board, United States Geological Survey, and DEHS are conducting a three-year study to determine how septic tank/seepage pit systems are adversely impacting groundwater quality in the Victor Valley area. A model will be developed to allow assessment of the impact, and the Regional Board will use the assessment as a basis for requiring sewering for new construction or implementing prohibitions to cause sewering in developed areas.

Poorly sited, constructed, and maintained septic systems can degrade groundwater by inadequate treatment of human and other household wastes. Even properly operating systems may still degrade groundwater with discharged nitrates, bacteria, and especially hazardous household wastes. The County's Draft Hazardous Waste Management Plan, developed by DEHS, includes a section on the program dealing with household hazardous wastes.

Prohibition Areas: On-Site Sewage Disposal

Potential threats to groundwater quality established by studies have resulted in the creation of limitations in on-site sewage disposal in the following areas:

1. Lahontan Region

    a. Apple Valley/Desert Knolls

    b. Lake Arrowhead Community Service District

2. Colorado Region

No designated prohibition areas.

3. Santa Ana Region

a. Grand Terrace - Minimum one acre and perc test.

b. Yucaipa/Calimesa - Minimum one acre and perc test.

c. Lytle Creek (above 2600 feet) - Minimum one acre, 200 ft. from stream, and perc test.

d. Mill Creek (above 2600 ft) - Minimum one acre, 200 ft. to stream, and perc test.

e. Bear Valley (includes Baldwin Lake drainage area). Engineer report and perc test, one acre or greater normally required.

f. Fontana/Bloomington - No exemption criteria but nitrate monitoring may be required (DEHS MOU).

g. Lake Williams Area.

Source of Maps - Respective RWQCB

Location of Map - DEHS

Reason - On site sewage disposal system criteria and exemption criteria in these prohibition areas directly and indirectly affect/determine land use and development and current MOUs with EHS.

Soil Percolation: Test Results/Areas

A sample map of the Yucaipa area by parcel number utilizing approximately 2400 perc tests reviewed and approved by DEHS was developed by DEHS. The map is located in DEHS.

Because on-site sewage disposal design is based on soil percolation rates, areawide perc rates allow for site specific sewage disposal system design and conversely justify the need for a perc test due to the variability of the area's soil (Blue Book).

Needed - Input of DEHS perc data from 1980 to date into computer.

Sewage Holding Tanks

Installation of sewage holding tanks is regulated by Article 4, Chapter 8, Div. 3, Title 3 of San Bernardino County Code. The purpose of this Article is to assure that sewage holding tanks meet minimum standards as to construction, location, and maintenance in order to protect public health but yet to allow construction on pre-existing parcels of land where more conventional sewage disposal methods may not be allowed. The code provides for annual permits and penalties for violations administered by the DEHS. Installations may be made anywhere in the unincorporated area of the County with the approval of a governing sewering entity, or as an emergency measure for an existing structure where no sewering entity exists.

Designated Maintenance Areas

Designated Maintenance Areas (DMA's) are regulated by Article 6, Chapter 8, Div. 3, Title 3 of San Bernardino County Code. The purpose of this article is to assure that individual sewage discharges in areas determined to have poor or marginal conditions for on-site sewage disposal meet all code requirements. A biennial permitting system has been established to manage this system and assure that periodic maintenance is done so that treatment of sewage wastes remains adequate. This article applies only to areas specifically designated by action of the Board of Supervisors. Maps of these areas are kept on file by the Clerk of the Board and by DEHS.

Multiple Ownership Septic Systems

Multiple Ownership Septic Systems (MOSS) are regulated by Article 7, Chapter 8, Div. 3, Title 3 of San Bernardino County Code. The purpose of this article is to assure that a responsible party is present to do regular maintenance and any emergency repairs necessary. The article requires a corporation be present and that a bond be posted to assure legally responsible and liable person is present in the event of a system failure and that sufficient funds are available to make emergency repairs should such be required. This article can

be applied anywhere within the unincorporated area of the County.

Dry Sewers

"Dry Sewers" refer to the installation of a standard sewer line to be used for future connection to a community sewer system. The dry sewers are sometimes required to be installed in new development where it is recognized that there will be wastewater collection and treatment facilities available in the near future. The sewer line, installed in addition to individual subsurface disposal systems, is installed in the ground and sealed off until the connecting community sewer is available.

A requirement for dry sewers initially comes from the DEHS following consultation with the applicable RWQCB and the wastewater agency serving the area. Generally, developers have accepted the need for dry sewers as a positive element in a project which obviates a subsequent need for digging up roads in order to retrofit a community with a wastewater collection system. At present, dry sewers are required in the Fontana-Bloomington area, and the Chino Hills, both in the County's Valley planning area; the Victor Valley area of the North Desert planning area has also had dry sewers required on certain projects.

At the present time, when subdivisions are reviewed for approval by DEHS, a requirement for dry sewers is included with the conditions for approval under the following conditions:

1. The tract is planning subsurface disposal for sewage effluent and either a, b, or c:

    a. The sewering entity has a master plan and the tentative tract lies within 600 feet of a line proposed to be constructed within 10 years.

    b. The sewering entity has a sewer line within 600 feet of the project, but has refused service to the tract because it is outside the boundaries of the entity (usually a city service).

c. The Regional Water Quality Control Board has required dry sewers as a condition of the waste discharge requirement.

13. San Bernardino County Office of Special Districts

The Office of Special Districts has the responsibility of managing the operation of over 100 Board-governed special districts, improvement zones, and county service area (CSAs) within the unincorporated areas of the County. These various districts, zones, and CSAs provide a wide range of services, including wastewater collection and treatment in some areas. Of the existing public wastewater treatment facilities described earlier in the report, the following are operated by the County Office of Special Districts or area governed by the Board of Supervisors:

CSA 70 S-3 (Lytle Creek)
Crestline Sanitation District
CSA 70 B (Helendale)
CSA 82 (Trona/Pioneer Point)
CSA 42 (Oro Grande
CSA 64 (Silver Lakes)

A number of other special districts are self-governed, and operate wastewater collection and treatment facilities. There are also a number of special districts with sewer or sanitation powers that are not currently operating wastewater collection or treatment facilities, but may in the future.

14. Wastewater Reclamation

Since the early 1900's, water and wastewater agencies have utilized reclaimed wastewater for agricultural and landscape irrigation. At present approximately 50 wastewater reclamation plants treat and distribute reclaimed wastewater in Southern California. Eleven of these wastewater facilities are located in the County of San Bernardino, as follows:

1. California Institute for Men, Chino

2. Chino Basin Municipal Water District, Regional Plant No. 1

3. Chino Basin Municipal Water District, Regional Plant No.2, Chino

4. City of Colton

5. City of Redlands

6. City of Rialto

7. City of San Bernardino

8. City of Barstow

9. Crestline Sanitation District

10. Lake Arrowhead Community Services

11. Victorville Sanitary District

Wastewater re-use and water reclamation are integral parts of Southern California's water supply. Approximately 155,000 acre-feet per year (AFY) of wastewater is currently reclaimed. The largest use of reclaimed wastewater is for groundwater recharge, with over 100,000 AFY being utilized in this way. In the County of San Bernardino, the 1986 wastewater flow and reclamation situation is summarized below in Table 5.

Table 5

Wastewater Flow and Reclamation in the County of San Bernardino, 1986

Total Wastewater Production	Reclaimed Wastewater	% of Total
84,785 AF	2,361 AF	2.8%

Uses of Reclaimed Wastewater

Groundwater Recharge	Irrigation
258 AF	2,103 AF

The future use of reclaimed water is expected to increase steadily, both within San Bernardino County and the Southern California region. The Department of Water Resource (DWR) estimates in their Bulletin 160-83 an increase to 470,000 AFY by 2010, representing a threefold increase over existing use. Recent studies indicate this estimate may overly optimistic. DWR is currently preparing an update of Bulletin 160-83 which may reduce earlier projections. Recent projections based on State Water Contractors discussions with local water agencies and results from the Metropolitan Water District's

Local Projects Survey regarding the use of reclaimed water in Southern California are as follows:

Year	Total AFY
1987	155,000
1990	198,000
2000	260,000
2010	314,500

The above projections are not assured due to the myriad of constraints confronting water agencies.

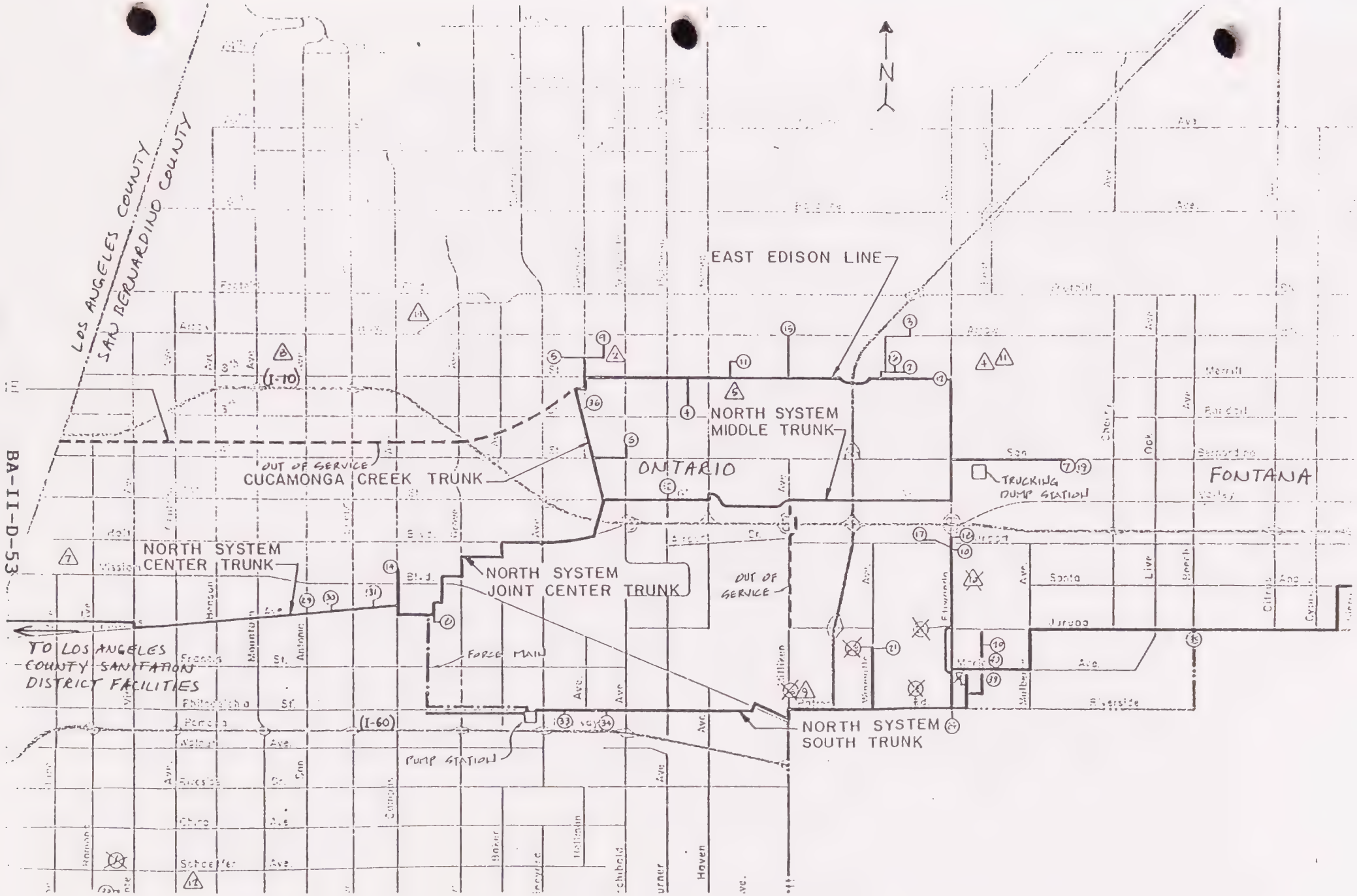
15. Non-Reclaimable Waste Systems

There are two non-reclaimable waste systems, also known as "brine lines" operating in San Bernardino County. Both are in the West Valley planning area and are also within the CBMWD service area. These systems are called the Northern System and the Southern System. Their purpose is to collect saline or brine wastes, primarily from industrial dischargers, in order to export salts from the Chino Basin for treatment and discharge into the Pacific Ocean. A popular misconception is that these systems are for industrial hazardous or toxic waste. This is not so, as there are quality restrictions for heavy metals and other waste, however there are no restrictions on salinity.

Northern System

CBMWD operates the Northern System, which collects industrial wastes primarily from Ontario, Rancho Cucamonga and Fontana industrial areas.

The Northern System non-reclaimable waste line generally runs westerly from Fontana to the Los Angeles/San Bernardino County boundary in Montclair, where it continues to a treatment plant in the city of Carson for partial secondary treatment and is then discharged into the ocean. CBMWD has a contract with the Los Angeles County Sanitation District for a fixed amount of capacity for wastes generated within the District's service area. The capacity contract is with the County Sanitation Districts of Los Angeles County (CSDLAC). The amount of capacity acquired by CBMWD in the CSDLAC system is 30 cubic feet per second, or approximately 19.5 MGD. The system can also be used by CBMWD for disposal of domestic wastewater should their own treatment plants be temporarily unable to provide adequate treatment. Fig. 13 shows the Northern System trunk lines.



NON-RECLAIMABLE WASTE LINE (north system)

Fig. 13

Southern System

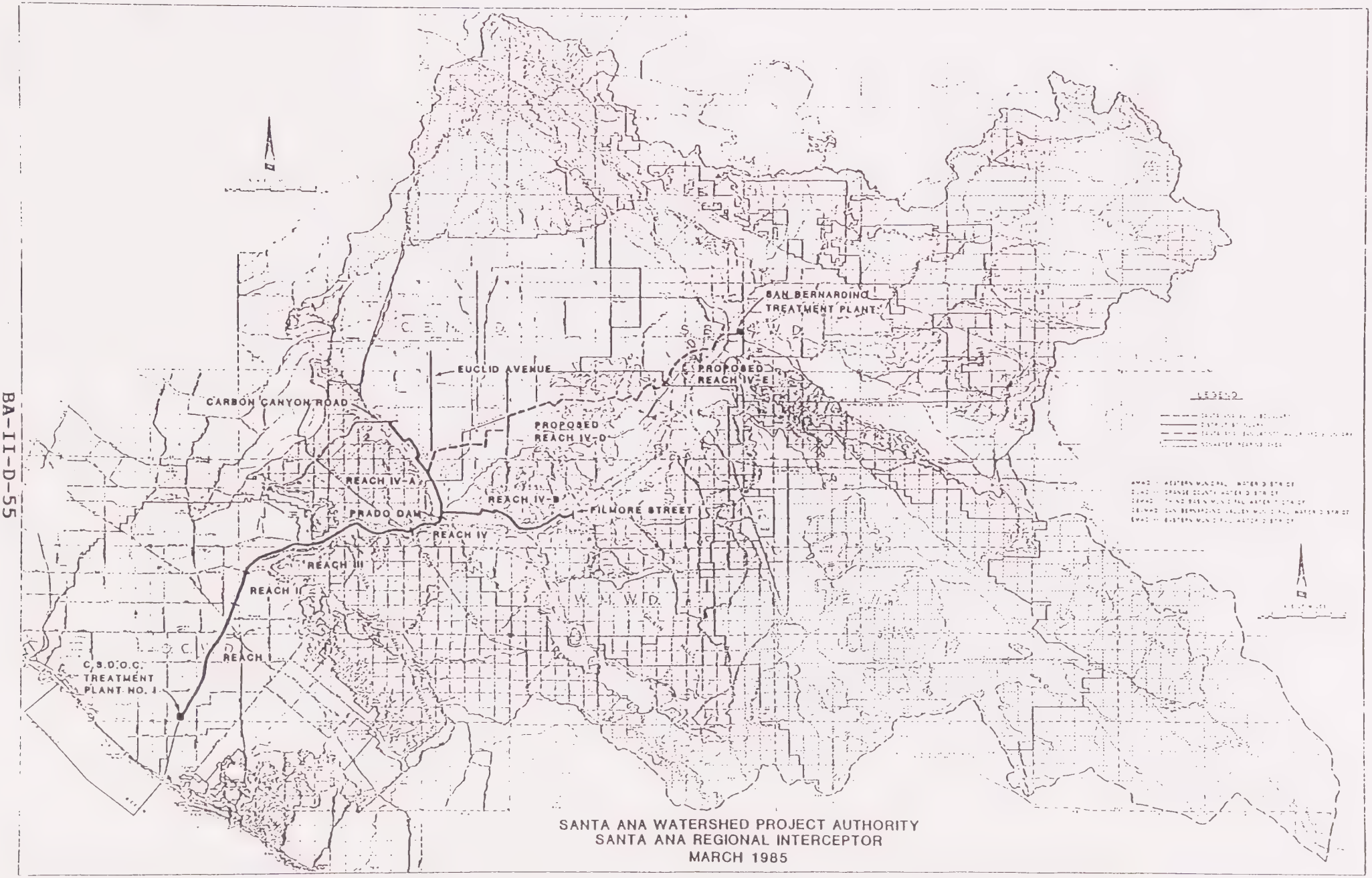
The Southern System consists of the Santa Ana Regional Interceptor (SARI), and is operated by the Santa Ana Watershed Project Authority (SAWPA) and CBMWD.

The completed portions of the SARI line, from Fillmore Street in the City of Riverside and Carbon Canyon Road in the city of Chino, to the Orange County Sanitation plant in Fountain Valley, carry saline wastewater and agricultural return water for treatment and discharge to an ocean outfall line five miles into the Pacific. The capacity of the SARI line is 30 MGD, with approximately 20 MGD still available for future use. CBMWD owns 2.5 MGD of capacity in the SARI line and can buy additional capacity if available. It is proposed to extend the SARI line from the Chino area to the city of San Bernardino's wastewater treatment plant. The SARI line can also be utilized by CBMWD for disposal of domestic wastewater as a backup system to their treatment plants. Fig 14 shows the extent of the SARI line, both existing and proposed, from San Bernardino City to the Orange County Sanitation plant.

CBMWD's southern Non-Reclaimable Waste System includes Reach IV-A of the SARI line and a 1.5 mile long trunk sewer extension known as the Chino Industrial Waste Line. The industrial Waste Line is located within Monte Vista, Edison and Yorba Avenues. The line functions as a disposal point for industrial wastes generated within the Chino area. Reach IV-A of SARI is rated at a peak wet weather flow (PWWF) capacity of approximately 10 MGD. The PWWF capacity of the portion of the Chino Industrial Waste Line within Edison Avenue is 0.5 MGD. The balance of the Chino Industrial Waste Line has a PWWF capacity of approximately 1.5 MGD. Chino Basin Municipal Water District is responsible for the operation of the southern system in terms of issuing permits to industry which utilize the system as a disposal point.

16. Santa Ana Watershed Project Authority (SAWPA)

SAWPA was formed in 1968 to develop a long-range plan for managing, preserving, and protecting the quality of water supplies in the Santa Ana basin. SAWPA's program is to plan, finance, construct, and operate projects which relate to water quality/quantity management. Member agencies include Chino Basin Municipal Water District, San Bernardino Valley Municipal Water District, Western Municipal Water District (Riverside Co.), Eastern Municipal Water District (Riverside Co.), and Orange



NON-RECLAIMABLE WASTE LINE (south system)

Fig. 14

County Water District. These agencies are involved in the provision of water as well as wastewater treatment,and collectively represent more than 90% of the water users of the Santa Ana Watershed. Fig. 15 indicates the service areas of these agencies and the watershed boundaries.

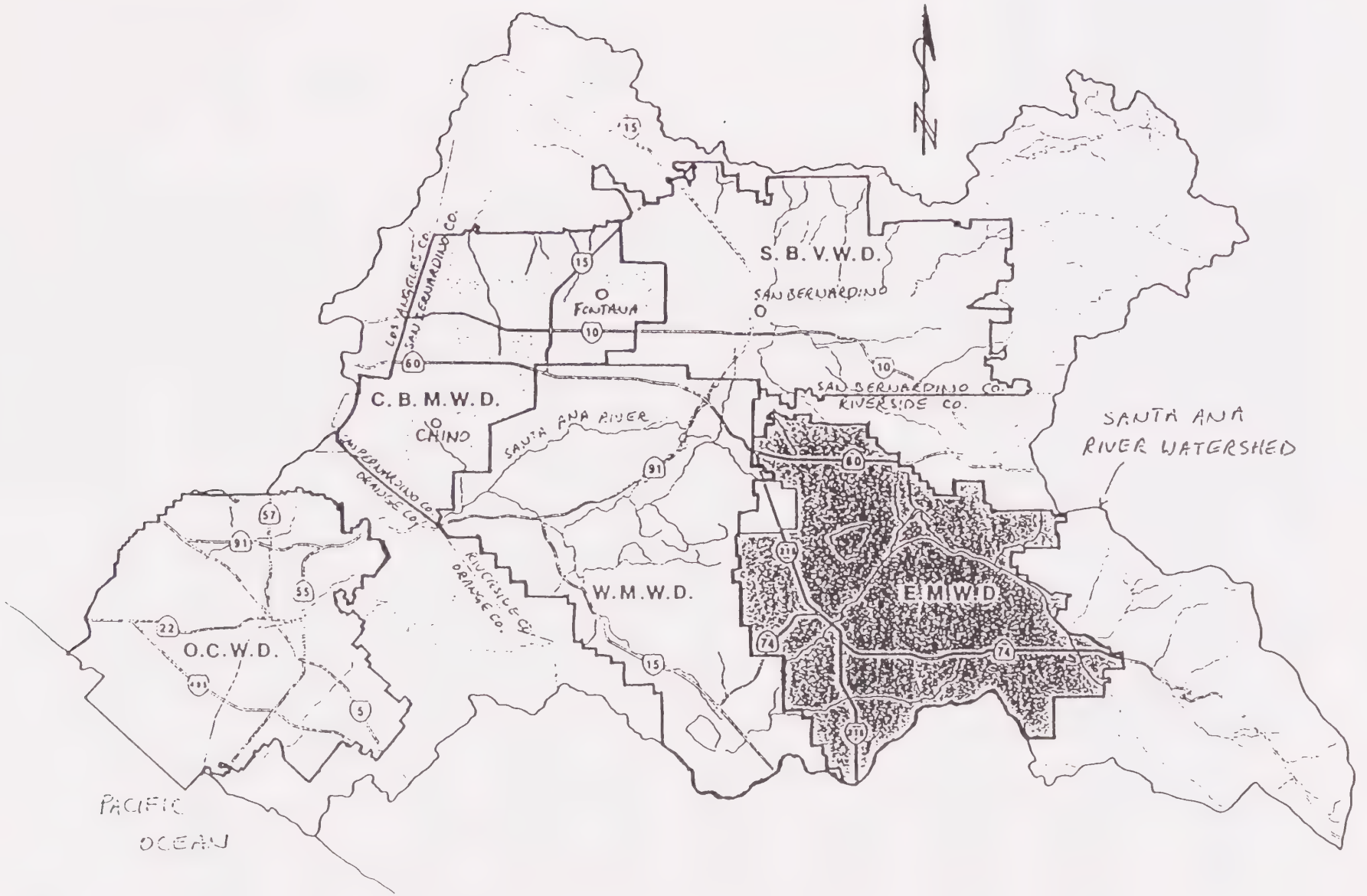
In addition to its member agencies, SAWPA coordinates its activities with the Santa Ana RWQCB, the Metropolitan Water District of Southern California, the State Department of Water Resources, the State Water Resources Control Board, and federal agencies such as the U.S. Bureau of Reclamation and the U.S. Army Corps of Engineers. Projects planned for the future by SAWPA in San Bernardino County include:

- Extension of the SARI line from Chino area to San Bernardino.
- Development of a Facilities Plan to address the impact of the dairy industry on water quality in the watershed.
- San Bernardino Tertiary Regional System for the cities of San Bernardino, Colton and Rialto.

SAWPA is also conducting a study of nitrogen in the Upper Santa Ana Watershed which will be crucial in determining whether or not the Santa Ana RWQCB requires public wastewater treatment plants to upgrade their treatment. If required, there will be far-reaching financial impacts on East Valley planning area treatment plants. A sewer line is currently being constructed to carry high TDS wastewater generated by the California Rehabilitation Center in the Chino area to the SARI line to reduce salt loading on the basin.

Santa Ana River Dischargers Association (SARDA)

SARDA is an association of agencies who operate wastewater treatment facilities which discharge to the Santa Ana River. The association was formed in 1987 in order to promote the common interest of wastewater agencies which discharges to the Santa Ana River. The goals and objectives of SARDA include providing assistance to the Santa Ana RWQCB in the Basin Planning Process, the development of a collective forum to promote the common interests of these agencies and to provide a constructive and positive contribution to the protection of legitimate beneficial uses of the Santa Ana River.



SAWPA Member Agencies

Fig. 15

18. East Valley Corridor Specific Plan

The East Valley Corridor Specific Plan is being prepared for the County unincorporated area between the cities of Redlands, Loma Linda and San Bernardino. As part of the Specific Plan a draft Specific Plan was produced in December, 1987, and a facilities plan was also prepared (Jan. 1988), in addition to a draft EIR in February 1988. This information is presented as the most recent example of the County's Community Plan/Specific Plan process in relation to the analysis of public services, in this instance the wastewater issue. Other public services, such as roads, water supply, stormwater drainage, and community facilities are also addressed.

Glossary

activated sludge process: A type of aerobic digestion of wastewater used primarily in large treatment facilities.

ad valorem tax: A tax based on the value of real property.

aerobic digestion: Process using bacteria that require oxygen for reduction of organic sludges produced from various treatment operations.

average daily flow: The average total flow of wastewater which is treated over the course of a single day averaged for a total year. Wastewater flows fluctuate over the period of a day and also vary seasonally due primarily to infiltration from rainfall.

BOD: Biochemical oxygen demand; an index of the amount of biodegradable organic material in a water sample.

CBMWD: Chino Basin Municipal Water District

clarifier: Used in sedimentation process for the separation of suspended particles to produce a clarified effluent and a concentrated sludge.

COD: Chemical oxygen demand; an index of the total organic content of a water sample.

collection system: The complex of pipes (mains, trunk lines, interceptors) and related equipment (siphons, lift stations, etc.) carrying sewage to the treatment plant.

connections: Individual residential, commercial, or industrial hook-ups to a sewage collection system.

CSA: County Service Area

dry sewer: A standard sewer line to be used for future connection to a community sewer system.

EDU: Equivalent dwelling unit.

effluent: Liquid flow or wastewater remaining after treatment and discharged to designated receiving waters.

evaporation ponds: Used for the treatment of liquid wastes directly on land in arid regions.

hydraulic capacity: The ability of a treatment plant to process

wastewater, at a rate of flow measured in MGD.

infiltration: Water other than wastewater that enters a sew system (including sewer service connections) the ground through such means as defective p pipe joints, connections, or manholes. Infiltr does not include, and is distinguished from, in

inflow: Water other than wastewater that enters a sewe system (including sewer service connections) sources such as roof leaders, cellar drains, drains, area drains, foundation drains, dra from springs and swampy areas, manhole cove cross connections between storm sewers and sanit sewers, catch basins, cooling towers, stc waters, surface runoff, street wash waters, drainage. Inflow does not include, and distinguished from, infiltration.

influent: Untreated wastewater entering the treatment plan from the collection system.

infrastructure: The basic utilities and services necessary to support development, e.g., sewer, water, and roads, etc.

interceptor: A sewer whose primary purpose is to transport wastewaters from collector sewers to a treatment facility.

lift station: Pumping installations used at various points in collection system and at wastewater treatment plant to lift sewage and/or sludge (and in some cases stormwater runoff).

MGD: Million Gallons per Day, a rate of flow.

outfall: Pipe carrying effluent or sludge from wastewater treatment plant for disposal into designated receiving waters.

paralleling: Expansion of sewage line capacity by construction of a second line along the same route.

percolation ponds: Used for the recharge of secondary or tertiary effluent into the natural groundwater table.

primary treatment: The settling of raw sewage, usually accompanied by skimming of floatables and chlorination.

Regional Water Quality Control Boards (RWQCB): California's RWQCBs set legal treatment and discharge requirements for wastewater treatment plants.

Santa Ana Regional Interceptor (SARI): Interceptor constructed by the Santa Ana Watershed Project Authority (SAWPA) as a brine line for the removal of industrial and agricultural wastewater. It is also being used for carrying untreated municipal wastewater form the urbanized portion of Riverside and San Bernardino County to Orange County for treatment and disposal.

SARDA: Santa Ana River Dischargers Association

SAWPA: Santa Ana Watershed Project Authority

secondary treatment: The biological stabilization and removal of fine suspended solids, BOD, and COD from wastewater.

septic tank: An underground vessel for treating wastewater, usually from a single dwelling or building by a combination of settling and anaerobic digestion. Effluent is usually disposed of by leaching. Settling solids are pumped out periodically and hauled to a treatment facility for disposal.

sludge: One of the products of primary, secondary, and tertiary treatment; results from the anaerobic (or aerobic) digestion of organic water in the sewage; a semi-liquid mass composed of solids removed from sewage during wastewater treatment.

sludge drying beds: A contained area designated for the removal of liquids from sludge through evaporation, underdrains or drainage to dewater the sludge.

stabilization ponds: A shallow body of water contained in an earthen basin; used as a primary means of aerobic digestion of wastewater for certain types of treatment facilities.

SWRCB: State Water Resources Control Board

tertiary treatment: Advanced wastewater treatment used to remove pollutants not affected by primary and secondary treatment and to produce an effluent that is suitable for reuse.

treatment capacity: The amount of influent able to be treated by primary, secondary, or tertiary levels. Treatment plant capacities are rated according to the

average flow they are capable of treating over the course of a single day averaged for a total year. This flow level can fluctuate daily, or seasonally (based primarily on rainfall levels and resulting infiltration of rainwater to the system).

trickling filter process: A type of aerobic digestion used in smaller wastewater treatment facilities and for high strength industrial wastes.

VVIEP: Victor Valley Infrastructure Enhancement Program.

VVWRA: Victor Valley Wastewater Reclamation Authority.

SOLID WASTE MANAGEMENT

SOLID WASTE MANAGEMENT

I. INTRODUCTION

Californians produce over 50 million tons of solid waste per year, with approximately 30 million tons disposed of in landfills. In San Bernardino County, approximately 3 million tons of solid waste is generated each year (8,000 tons each day); approximately half of this is disposed of at various sanitary landfills throughout the County. If left uncontrolled, these wastes could threaten public health and safety and impair environmental quality. Additionally, the economic value of the recoverable portion of these wastes is substantial. To deal with the potential health and safety threats and to minimize the loss of resources inherent in the disposal of wastes, the State has developed a program of solid waste management. The State also requires the issue of solid waste to be addressed in a jurisdiction's General Plan.

Sound planning practice and the law require close coordination of solid waste management planning with local general plans. General plans contain information, assumptions, and projections which should serve as the basis for county solid waste management planning. General plans, for example, project future population growth and economic activity and designate areas proposed for residential, commercial, industrial, agricultural, and institutional land uses. General plans also contain information regarding transportation routes, existing land uses, and environmental conditions. This information is critical to developing estimates in the county solid waste management plans.

San Bernardino County consists of three primary geographical areas: Valley, Mountain, and Desert regions, each having unique sociological, economic, demographic, climatic, and topographic conditions. The County population is approximately 1.2 million (1988) and is projected to be 2.2 million in 2010 (SCAG draft 1988 projection). Approximately 80% of the residents reside in the Valley area, which includes 13 incorporated cities. Six incorporated cities are in the Desert area with an estimated population in excess of 120,000 (1988).

The County of San Bernardino's Solid Waste Management Plan (CoSWMP), adopted in 1986, is at present being revised. A new CoSWMP is expected to be completed in 1989. The County's Office of Planning (General Plan Team), the Solid Waste Management Department, and the Department of Environmental Health Services (DEHS) will be participate in the update of the Solid Waste Management Plan and have collaborated to

produce this background report to address the issue of solid waste disposal for the General Plan Update program.

The County's organizational chart for dealing with solid waste issues is shown in Figure #1. The range of issues which confront the County in dealing with solid waste can be summarized briefly as follows:

1. Recycling (materials recovery)

    a. To what extent can recycling solve the solid waste management crisis?

2. Resource recovery (waste to energy)

    a. Is it still a viable option in view of the many denials for new facilities in the Southern California region?

3. Future landfilling in the Valley

    a. New (proposed) locations
    b. Expansion of current sites
    c. Reopening of closed sites

4. Landfill closures

    a. The scenario under new legislative requirements

5. Air and water quality testing, monitoring, and maintenance of landfills

    a. Current sites
    b. Closed sites

6. Current legislation

    a. Trends
    b. Impacts on solid waste management

7. Transfer stations

    a. Feasibility
    b. Locations

8. Recycling centers

    a. Established at landfills in Phelan, Victorville, and Heaps Peak.

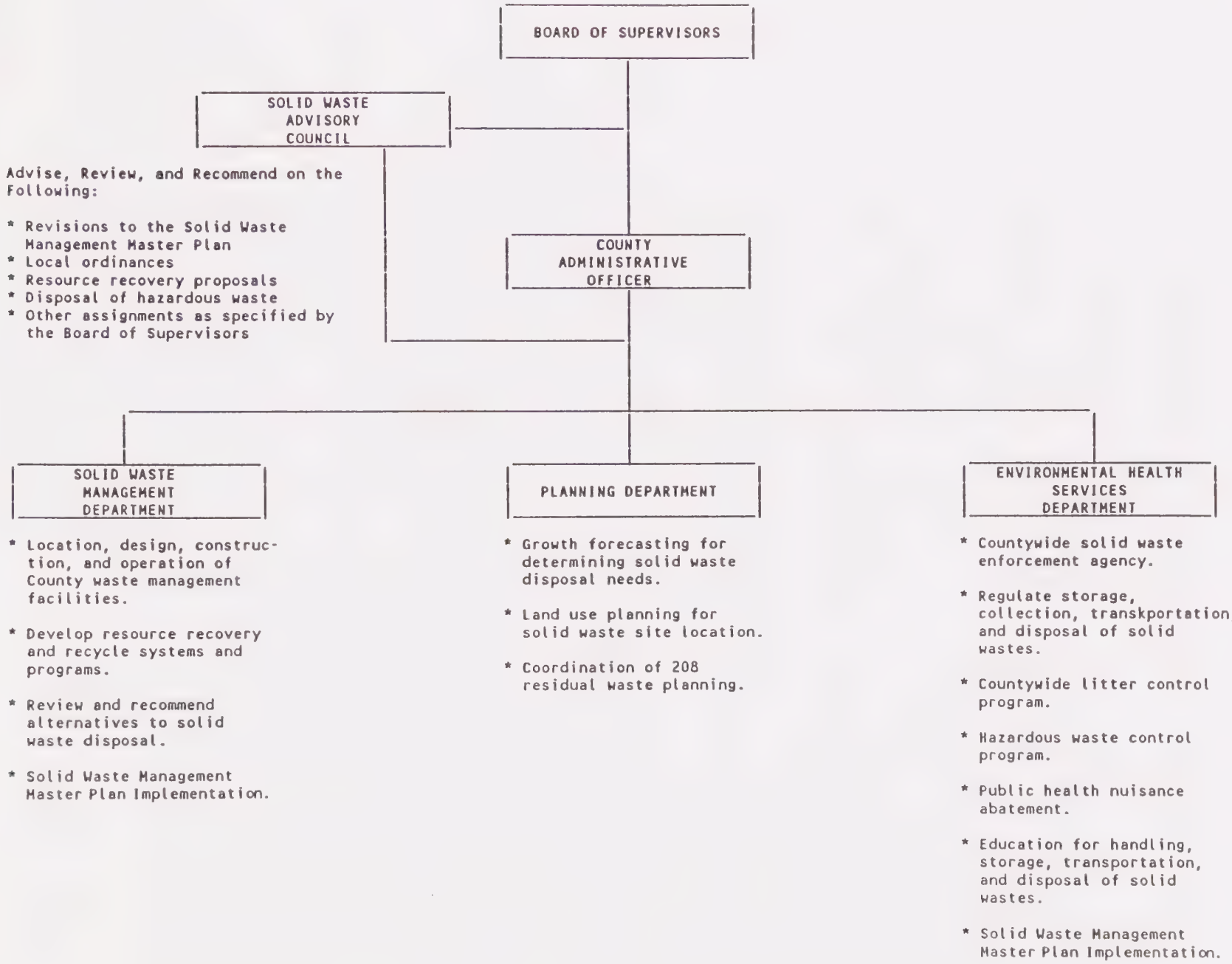

BOARD OF SUPERVISORS
SOLID WASTE ADVISORY COUNCIL
Advise, Review, and Recommend on the Following:
* Revisions to the Solid Waste Management Master Plan
* Local ordinances
* Resource recovery proposals
* Disposal of hazardous waste
* Other assignments as specified by the Board of Supervisors
COUNTY ADMINISTRATIVE OFFICER
SOLID WASTE MANAGEMENT DEPARTMENT
* Location, design, construction, and operation of County waste management facilities.
* Develop resource recovery and recycle systems and programs.
* Review and recommend alternatives to solid waste disposal.
* Solid Waste Management Master Plan Implementation.
PLANNING DEPARTMENT
* Growth forecasting for determining solid waste disposal needs.
* Land use planning for solid waste site location.
* Coordination of 208 residual waste planning.
ENVIRONMENTAL HEALTH SERVICES DEPARTMENT
* Countywide solid waste enforcement agency.
* Regulate storage, collection, transkportation, and disposal of solid wastes.
* Countywide litter control program.
* Hazardous waste control program.
* Public health nuisance abatement.
* Education for handling, storage, transportation, and disposal of solid wastes.
* Solid Waste Management Master Plan Implementation.

Figure 1

9. Specific waste disposal issues

   a. Tires
   b. Plant and woody materials
   c. Inert materials
   d. Hazardous materials
   e. Dairy wastes
   f. Automobile shredded waste (fluff)
   g. Liquid waste (septage)
   h. Sludge disposal

10. Other solid waste management issues

   a. Potential liability to landfill owners and operators

11. Waste disposal regional aspects

   a. San Bernardino County solid waste disposal outside the County; adjacent counties' solid waste disposal in San Bernardino County; possible regional facilities.

This section of the background appendix will attempt to identify, inventory, quantify, and describe the topic of solid waste disposal and its associated issues from a county-wide perspective. The solid waste disposal issue is part of the overall Man-Made Resources Component of the General Plan Update, which is intended to establish a framework for the coordination of the County's land use planning process with the planning of public services and facilities. It should be noted that a separate section of the background appendix deals with the topic of Hazardous Waste as part of the Man-Made Hazards Component of the General Plan Update.

A. Definitions and Responsibilities in Solid Waste Management

Solid Waste is defined as all putrescible and nonputrescible solid, semisolid, and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, manure, vegetable or animal solid and semisolid wastes, and other discarded solid and semisolid wastes (Government Code Section 66719). Solid waste does not include hazardous waste as defined by Government Code Section 66714.8.

A Solid Waste Facility is a disposal facility, disposal site (or a solid waste transfer/processing station (Government Code Section 66720.1).

A Transfer/Processing Station includes those facilities utilized to receive solid wastes, temporarily store, separate, convert, or otherwise process materials in the solid wastes, or to transfer the solid wastes directly from smaller to larger vehicles for transport. Transfer/processing station... does not include any facility the principal function of which is to received, store, separate, convert, or otherwise process, in accordance with state minimum standards, manure; nor does it include any facility, the principle function of which is to receive, store, convert, or otherwise process wastes which have already been separated for reuse and are not intended for disposal (Government Code Section 66723).

Resource Recovery is the reclamation or salvage of wastes for reuse, conversion to energy or recycling (Title 14, California Administrative Code Section 17225.58).

The San Bernardino County Board of Supervisors is responsible for the County Solid Waste Management Programs, while cities, through their respective councils, are responsible for solid waste management implementation within their jurisdictions. Under provisions of the 1972 Solid Waste Management and Resource Recovery Act, the County Board of Supervisors is responsible for preparing, revising, or amending a California Waste Management Plan consistent with State policy. Final approval is required by the California Waste Management Board. Table #1 organizes the various administrative assignments for relevant governing bodies.

The State's role is assumed by the California Waste Management Board which must concur with a local government's issuance of a solid waste facilities permit. Before doing so, however, the board must find that the proposed solid waste facility is consistent with the pertinent general plan as determined by the affected local government. Government Code Section 66796.41(b) states that a new or expanded site will be found consistent only if the following requirements are met:

- It is designated in the applicable city or county's general plan, as a site for a solid waste facility, or as a potential site for a solid waste facility.

TABLE I

GOVERNING BODIES ORGANIZATIONAL POLICY

ADMINISTRATIVE ASSIGNMENTS	POLICY	PUBLIC INFORMATION	FINANCING	PLANNING	ENFORCEMENT OF STANDARDS & ORDINANCES	OPERATION OF SYSTEM	LEGISLATION
ENVIRONMENTAL PUBLIC WORKS AGENCY (EPWA)	Request Plan, Policy, and Ordinance revisions for collection, storage, and disposal on resource recovery.	Resource recovery and disposal systems; environmental health education, litter control, source separation.	Disposal and resource recovery; review and recommend disposal and fees; grant application, surveillance, enforcement, planning; recommend changes in collection rates in unincorporated areas.	Coordinate SWMP revisions relative to disposal, transfer, and processing; coordinate SWMP revisions, environmental impact reports, zoning, land use planning.	Public health, safety, rates, aesthetic, litter, air, storage, collection, and disposal.	Disposal; transfer.	Recommend new and amended legislation for County consideration.
BOARD OF SUPERVISORS	Approve Master Plan and revision, set County Policy and adopt ordinances for unincorporated areas.	Press and media contact via County Public Information Office, public hearings.	Approve budgets rate and financing methods.	Approve plan revision and land use planning in unincorporated areas.			Request new and amended legislation
CITIES	Approve Master Plan and revisions, adopt city ordinances, set city policy, request SWMP storage, collection, disposal, resource recovery.	Source separation and litter control where applicable.	Approve disposal and/or collection financing in cities.	Approve Plan revisions and land use planning in cities.	Enforce rates, regulate operators, enforce storage and collection standards.	Collection, disposal, and transfer of city waste.	
SOLID WASTE ADVISORY COUNCIL	Review and recommend plan revision, new ordinances and hazardous waste policy.			Review and recommend SWMP proposals, including resource recovery proposals.			Request new and amended legislation
PRIVATE INDUSTRY	Coordinate plan revision and new ordinances; Request plan policy and and ordinance revisions for collection, storage, and disposal.	Collection and storage practice.	Provide financing for collection, resource recovery and limited site operations as applicable.	Request Plan revision, collection, transfer, and processing systems.		Collection, disposal, and transfer of commercial, residential, industrial agricultural and special wastes.	Request new and amended legislation
WATER QUALITY CONTROL BD.	Set water quality policy.	Public information; design programs.	Provide financing for research and special projects.		Enforce State standards and requirements.		Request new and amended legislation
STATE WASTE MANAGEMENT BOARD	Approve Master Plan and revisions; set State policy relative	Public information; design programs.	Provide financing for research and special projects.	Plan revision and approval.	Enforce State standards and requirements.		Request new and amended legislation

- The land uses authorized adjacent to or near the site are compatible with the establishment or expansion.

An exception to this is provided if an area is zoned for the siting of a solid waste facility which is designed to produce an alternative source of energy, synthetic fuels, or reusable materials. This would be the case for waste-to-energy facilities, cogeneration plants, and materials recovery facilities. In these cases, the city or county must deem the project to be in compliance with the general plan (Government Code Section 66796.41(b)).

The San Bernardino County and respective city governments have established corresponding ordinances for the storage and collection of waste. The Cities of Colton, Ontario, Redlands, San Bernardino, and Needles provide municipal collection services to their residents while other cities contract with private refuse haulers to undertake waste collection. The County's unincorporated areas have been subdivided into ten refuse collection cells within which all private collectors are regulated through permits administered and enforced by the Department of Environmental Health Service (DEHS) of the Environmental Public Works Agency (EPWA). This will be discussed in greater detail later in this section.

II. CURRENT STATUS

A. Sources of Data/Analysis

Information has been gathered on the solid waste issue from the County's Solid Waste Management Department and the Department of Environmental Health Services (DEHS). Most of the information in this background report has been taken from the County's Solid Waste Management Master Plan (CoSWMP) adopted in 1986, which is not a part of the General Plan. The information has been updated to reflect current conditions to the maximum extent possible. Additional information has been obtained from the California Waste Management Board and the Southern California Association of Governments (SCAG).

B. Scope of Existing Conditions/Trends

There are 77 disposal sites located throughout the County. The County has operational responsibility for 21 facilities with direct responsibility to operate and maintain 15 landfill facilities; five are operated and maintained by one contractor; one transfer station

facility is operated by a private contractor. The City of Redlands operates it own landfill and the military installations within the County operate five landfills. The balance of the landfill facilities are owned and operated by private industry.

Approximately 3 million tons of solid waste is generated within San Bernardino County per year (8,000 tons/day). Approximately half of this is disposed at various sanitary landfills throughout the County. Large portions of waste, produced by agriculture and industry, do not enter the conventional waste stream, but are recycled through various methods. Sewage treatment plants generate an estimated 11,300 dry tons of sludge per year.

Approximately 1 million tons per year of commercial and residential waste are generated and a minor portion of agricultural and industrial wastes are disposed of at the County owned sites. Some private landfills accommodate a large percentage of inert material and are not generally classified in Subchapter 15 "Discharges of Waste to Land" (Title 23, Subchapter 15, Section 2524 of the California Code of Regulations) as Class III sites. More than 430,000 tons per year of residential, commercial, and industrial wastes are disposed of at non-County owned landfills.

1. Identification of Solid Waste

Solid waste has been identified by type, location, and quantities for the mountain, desert, and valley areas of the County. As shown on Table 2, significant variations in type of wastes identified are generated by industrial, commercial, and construction activities. Quantities vary depending on socio-economic levels, special requirements for clearing land in the mountain and valley areas together with special brush, agricultural, and dead animal disposal problems in sparsely populated areas of the County.

An informative report on dairy waste management in San Bernardino County prepared by Kaiser Engineers, Inc., Oakland, shows locations of dairies and dairy waste production for the Santa Ana Watershed Project Authority and identified 1,230 tons per day of dairy manure in the Chino-Corona area (see Table 3).

TABLE 2

GEOGRAPHIC WASTE DISTRIBUTION

1984

COUNTY AREA	RESIDENTIAL POPULATION	RESIDENTIAL TONS	COMMERCIAL EMPLOYEES	COMMERCIAL TONS	INDUSTRIAL EMPLOYEES	INDUSTRIAL TONS	TOTAL TONNAGE
West Valley	402,200	238,600	95,600	167,100	41,700	171,200	576,900
East Valley	385,900	228,900	158,400	289,200	25,800	106,100	624,200
Mountain	41,600	24,700	17,500	32,000	1,650	6,800	63,500
Desert	177,000	105,000	53,600	97,800	4,600	19,000	221,800
SUBTOTAL	1,006,700	597,200	325,100	586,100	73,750	303,100	1,486,400
Countywide					Agriculture Wastes		679,600
					Demolition Wastes		98,600
					Special Wastes		48,500
TOTAL							2,313,100

REFERENCE: [1] San Bernardino County Planning Department, 1980 Census extrapolated to 1983.

[2] Waste Generation Factors: Residential ..... 3.25 lbs. per capita per day.
Commercial ..... 10.00 lbs. per employee per day.
Industrial ..... 22.50 lbs. per employee per day.

TABLE 3

DAIRY WASTE PRODUCTION

Chino-Corona Area[1]

	1979 TONS/DAY[2]	1984 TONS/DAY[2]
Total Manure Production as Corral Scrapings[3]	1,230	1,480
Manure Spread on Fields or Composted	440	400
Net Quantity of Corral Scrapings	790	1,080

REFERENCE:

1 72.5 percent of total Dairy Industry in San Bernardino and Riverside Counties.

2 "As is" basis at 30 percent moisture content.

3 Based on 10 1/2 lbs. per day of dry solids in corral scraping per "equivalent cows."

The estimated total solid waste production in San Bernardino County is shown on Table 4.

Solid waste loadings of various County operated sanitary landfill facilities are shown in Table 5 as projected through 1988. While it has been determined that solid waste generation factors differ by area, climate, socio-economic, and other factors, little information is available concerning differences in the composition of wastes.

Table 6 identifies the various waste components and their average percentage contained in a typical Municipal Solid Waste (MSW) composition within the County.

The County of San Bernardino has provided convenient sites for refuse disposal in all geographic areas, however, a small amount of refuse is disposed outside of the County. Agreements with Kern County permit disposal of wastes in the County through a rural bin collection system serving the community of Red Mountain which exports approximately 12 cubic yards of wastes per week for disposal at the Ridgecrest Site in Kern County. Refuse from the Kramer Junction area is disposed of in Boron (Kern County) through a joint agreement.

The County has entered into an agreement with the Colorado River Indian Tribe (CRIT) to accept Group III waste from San Bernardino County areas along the west side of the Colorado River from Parker Dam to Big River Community. The waste is being landfilled by CRIT on the Arizona side of the River, northerly of the City of Parker, Arizona.

The Black Meadows Landing Resort Community has engaged the collection services of a local hauler to pick up and haul wastes to the CRIT Landfill on the Arizona side of the River. No landfill is currently being operated at the Resort Community.

2. Collection System

San Bernardino County is divided into ten collection areas in which private and municipal collectors are regulated by permits administered by DEHS. Collection areas vary due to economic base, etc., and in some portions of the County's unincorporated areas, no collection services are available. The Cities of Adelanto, Colton, Needles, Ontario,

TABLE 4

TOTAL SOLID WASTE PRODUCTION FOR SAN BERNARDINO COUNTY

1984

CATEGORY OF WASTE	TONNAGE PRODUCED	PERCENTAGE OF SUBTOTAL	PERCENTAGE OF TOTAL
MUNICIPAL			
Residential	597,200	44.0	19.0
Commercial	586,100	44.0	18.0
Demolition	112,500	8.0	3.0
Special			
Street Sweepings	16,500	1.0	---
Sewage and Septic	32,000	3.0	1.0
SUBTOTAL	1,344,300	100.0	41.0
AGRICULTURAL			
Manures	540,200	79.0	16.0
Fruit and Nut Crop	124,400	18.0	4.0
Field and Row Crop	15,000	3.0	---
SUBTOTAL	679,600	100.0	20.0
INDUSTRIAL			
Food Processing	58,650	50.0	2.0
Logging Debris	13,300	1.0	---
Sawmills and Planning Mills	33,800	3.0	1.0
Chemical and Petroleum Wastes	2,650	---	---
Heavy Manufacturing	1,113,550	91.0	36.0
Light Manufacturing	5,830	---	---
SUBTOTAL	1,227,800	100.0	39.0
TOTAL	3,251,700	---	100.0

TABLE 5

ESTIMATED SOLID WASTE LOADINGS

1984

SANITARY LANDFILL	TONS PER YEAR 1983/84	1984/85	1985/86	1986/87	1987/88
VALLEY					
Colton	239,000	250,900	258,500	271,400	285,000
Fontana	168,500	176,900	185,800	195,000	204,800
Milliken	414,500	435,200	457,000	479,800	503,800
San Timoteo	82,000	86,100	90,400	94,900	97,700
SUBTOTAL	904,000	949,100	991,700	1,041,100	1,093,300
MOUNTAIN					
Heaps Peak	33,000	34,000	35,000	36,000	37,100
Big Bear	24,700	25,500	26,200	27,000	27,800
SUBTOTAL	57,700	59,500	61,200	63,000	64,900
DESERT					
Landers	18,900	19,500	20,050	20,650	21,300
Newberry	700	700	750	750	800
Apple Valley	25,300	26,050	26,800	27,600	28,500
Morongo Valley	7,500	7,750	8,000	8,200	8,450
Barstow	24,400	25,000	25,900	26,700	27,500
Parker Dam	200	200	250	250	300
Baker	1,350	1,400	1,450	1,500	1,550
Hesperia	18,850	19,400	20,000	20,600	21,200
Trona-Argus	6,000	6,150	6,350	6,500	6,700
Yermo	3,900	4,050	4,150	4,300	4,400
Needles	2,700	2,750	2,850	2,950	3,000
Lenwood-Hinkley	9,400	9,650	9,950	10,250	10,550
Lucerne Valley	1,850	1,900	1,950	2,000	2,100
Phelan	6,700	6,900	7,100	7,300	7,550
Twentynine Palms	16,900	17,400	17,900	18,450	19,000
Victorville	42,250	43,500	44,800	46,150	47,550
SUBTOTAL	186,900	192,300	198,250	204,150	210,450
TOTAL	1,148,600	1,200,900	1,251,150	1,308,250	1,368,650

TABLE 6

AVERAGE COMPOSITION OF COUNTY MUNICIPAL SOLID WASTE

1988

COMPONENT	PERCENT (WEIGHT) AS DISCARDED
Newsprint	10.0
Cardboard	7.5
Aluminum	0.5
Ferrous	4.5
Glass	4.0
Miscellaneous Inerts	1.5
Mixed Paper	23.0
Yard Waste	17.0
Food Waste	8.0
Wood, Textile, and Rubber	20.0
Plastic	4.0
	100.0%

Redlands, and San Bernardino provide mandatory public collection service for their residences; and all other cities provide for collection services via private industry regulated by the County (attached Figures 2 and 3 depict County and Municipal service areas).

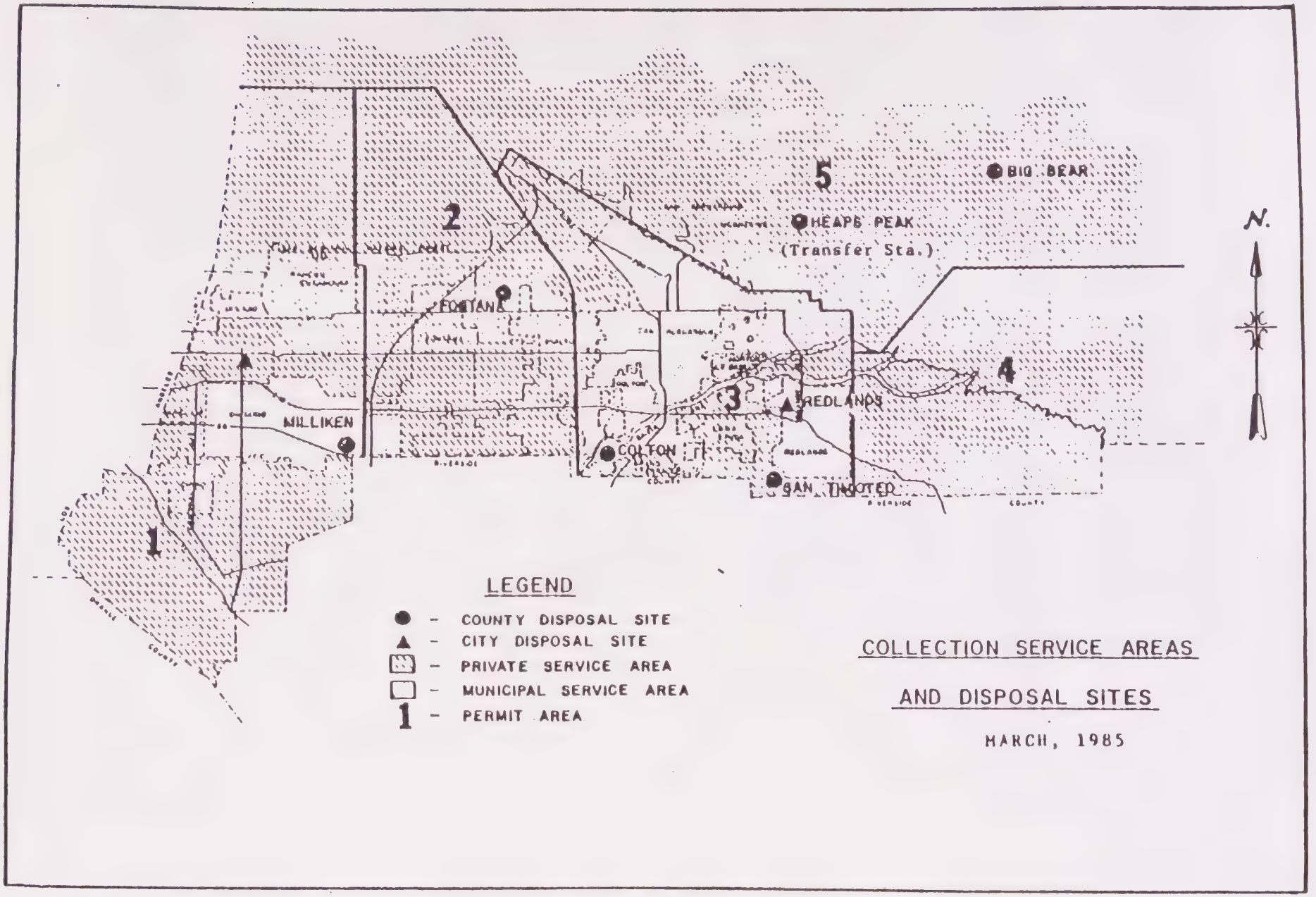
The minimum collection frequency in the County is weekly; however, several cities and a few unincorporated areas of the County provide twice-a-week collection.

Collection equipment varies within the County from the most modern compacting vehicles to older, multi-use converted trucks. The lack of uniformity of equipment is due to differences in population density, terrain, length of haul, space restrictions in streets and alleys, types of solid wastes, frequency of collection, and the financial capabilities of the collector or collection agency. These area-type characteristics resulted in the use of special vehicles designed to reduce labor, maintenance, and equipment costs.

San Bernardino County and several municipal refuse collection ordinances contain vehicle specifications to be used in the collection of garbage and rubbish. DEHS conducts a yearly inspection of private and public collection vehicles to ensure compliance with vehicle body construction, identification, and sanitary maintenance standards.

The Cities of Adelanto, Barstow, Colton, Needles, Ontario, Redlands, San Bernardino, Rialto, Victorville, and Upland provide for mandatory collection of residential wastes for approximately 445,000 individuals or 45% of the County population (1984). Some cities require mandatory collection and contract with private industry for refuse operations. The Cities of Fontana, Big Bear Lake, Grand Terrace, and Rancho Cucamonga do not require mandatory collection. However, the City of Fontana has issued an exclusive franchise to a private hauler on a long-term basis to provide optional service to their citizens.

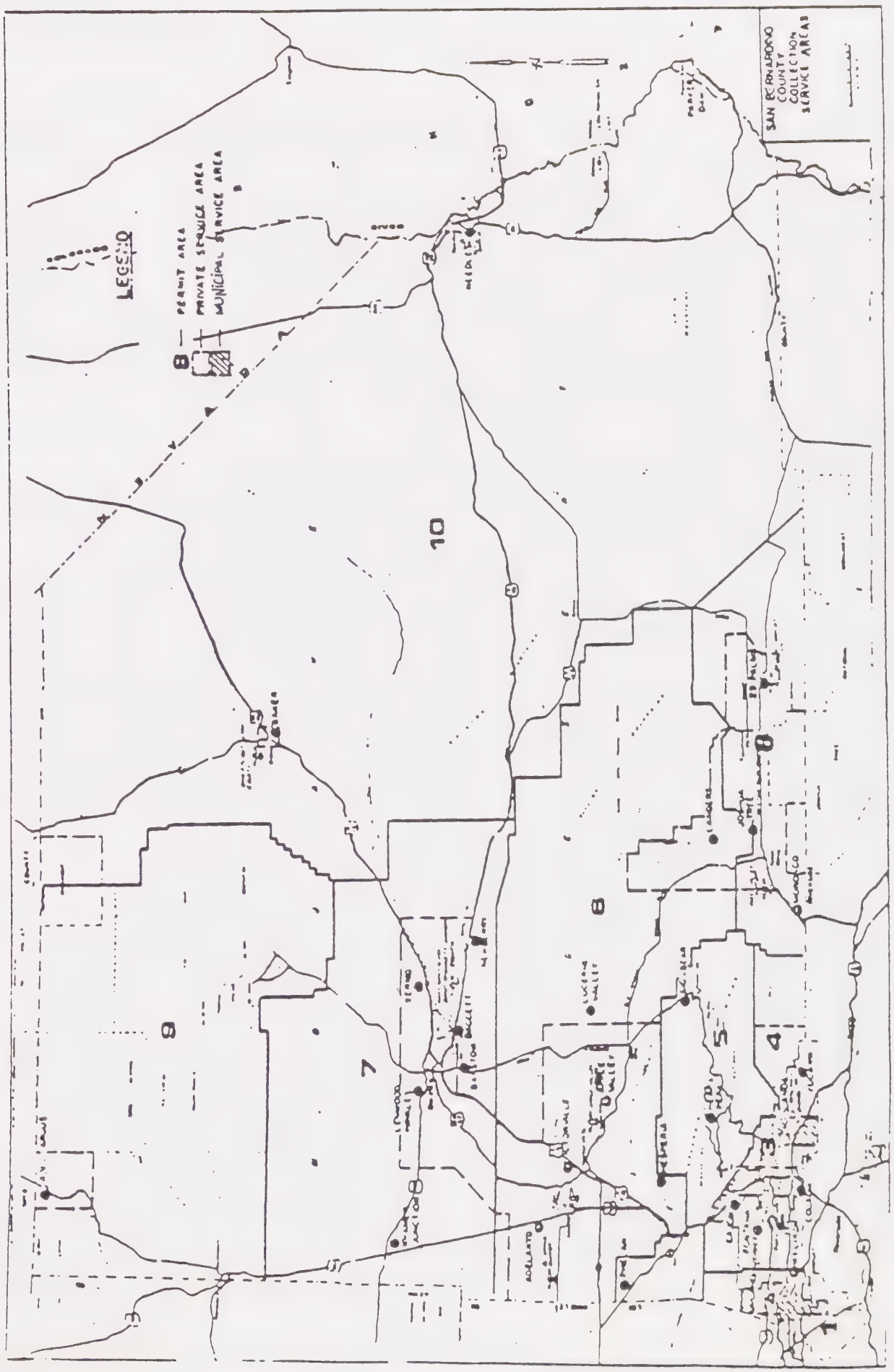
Arrangements for collection services are generally made with the private collector in County permit area and service areas not requiring mandatory service. Arrangements in mandatory service areas are made with the municipal public works departments



BA-II-D-78

Figure 2

Figure 3


LEGEND
PERMIT AREA
PRIVATE SERVICE AREA
MUNICIPAL SERVICE AREA
SAN BERNARDINO COUNTY COLLECTION SERVICE AREAS
10
9
8
7
6
5
4
3
2
1

or are automatically commenced with assumption of water utility services.

Each of the various military installations collects and disposes its wastes on-site with a portion for base personnel collected by civilian contractors and transported to County sites; e.g., Norton Air Force Base contracts with a private contractor. Twentynine Palms Marine Base contracts with the Twentynine Palms Disposal Company, George Air Force Base contracts with two private contractors, and Barstow Marine Supply contracts with Desert Disposal Company.

Commercial and industrial collection service is provided by both public and private agencies. The Cities of Colton, Ontario, Redlands, San Bernardino, and Upland provide large containers or bins which are rented to commercial and industrial establishments and multiple-dwelling units or other establishments producing large volumes of waste. The City of San Bernardino rents 2,500 bins (2, 3, 4, 6, 8, 30, or 40 cubic yards) as well as servicing 600 privately owned metal bins. The City owned containers are increasing at 160/year and the privately owned containers are increasing at 20/year. Fourteen daily commercial routes include ten automatic self-loading metal containers averaging more than $160,000 annual revenue. Private industry also has many collection bins.

The County's refuse collection ordinance, administered by DEHS, requires that all refuse collectors and haulers be issued permits and requires specific controls on the issuance of permits to new applicants, which specifies within which refuse collection area a collector may operate. The valley is divided into four refuse collection permit areas (Nos. 1, 2, 3, and 4), each covering approximately 90 square miles. The Mountain area comprises Permit Area No. 5. The Desert area is divided into five permit areas: No. 6 serving Adelanto and Victorville; No. 7, Barstow; No. 8, Yucca Valley; No. 9, Trona, and No. 10, the entire eastern half of the County.

Any refuse collection company operating with a County permit desirous of increasing collection rates must comply with requirements of Section 33.0212, San Bernardino County Code, and the

Refuse Rate Adjustment Policy established by the County Board of Supervisors.

In the past, San Bernardino County has granted rate increases to refuse collectors based upon County Refuse Rate Adjustment Policy. The procedure is based on a combination of annual consumer and producer price indices and subindices published by the Bureau of Labor Statistics, U.S. Department of Labor, which closely approximates the specific costs incurred in refuse collection operations. Each April the County Auditor-Controller, Management Services Division, determines the percentage increases in these various indices and recommends a maximum refuse industry rate index for the subsequent year. However, a growth rate reduction factor is used to prevent unequitable rate increases over a period of years by up to 2 percent when refuse collectors experience business growth during the previous year.

Prior to 1979, there were two classes of refuse collectors providing regular residential and commercial services. In 1979, two additional classes of collectors were created by enactment of a modification of the Refuse Collection Ordinance. The new Class B Collectors deal only with special wastes which include grease rendering wastes from restaurants and other such wastes. The Class C Collectors consist of industrial or commercial enterprises that collect and transport solid wastes resulting from their own business operations amounting to more than 1 cubic yard per week.

Fifty-four private and public refuse disposal operators are licensed in the County. Four of these are private special haulers; six private companies operate within the Cities of Barstow, Fontana, Montclair, Rialto, Upland, and Victorville; six are public collection services; and thirty-eight operate within the refuse collection permit areas of the unincorporated County area. Within Permit Area No. 1, there are nine private collection companies; within Area No. 2, five companies; within Area No. 3, five companies; within Area No. 4, a single company; within Area No. 5, seven companies; within Area No. 6, four companies; within Area No. 7, three companies; within Area No. 8, three companies; within Area No. 9, two companies; and within Area No. 10, a single company.

A review of the desirability of mandatory collection services in rural areas indicated that some consideration should be given to the different lifestyles of rural residents whose areas tend to be more self-sufficient and use the refuse disposal sites more frequently and during their normal activities. It appears that rural residents also personally dispose of more wastes not usually handled by collectors and public services, such as brush, dead animals, etc., than residents of urban areas. A collection system for only household waste is of little attraction to most of them. Strong opposition to a rural collection system was found in Newberry Springs where many ex-urban dwellers reside.

Subsequent to the most recent CoSWMP update, new factors have arisen which will now require the reexamination of mandatory service, particularly for the Mountain Resort areas from Crestline to Big Bear. A transfer station has been installed at the Heaps Peak Disposal Site where refuse is brought and placed into compactor units for transportation to the San Timoteo Canyon Site southwest of Redlands. The Big Bear Site will be phased out in the future and a replacement landfill or an alternate system must be identified for removing and disposing that refuse.

Individuals may no longer find it desirable to haul their own refuse to the new site location because of high fuel costs. The total collection, transportation, and disposal system could be more economical if all area residents participate in the financial support so that individual costs might be minimized. While this is not a popular idea, the impending closure of the sites coupled with increasing costs may require compliance with the mandatory collection proposal.

Urban areas in the County have different levels of collection service with little public interest in increasing frequency of collection, but some desire to increase the level of service to handle items which at present must be independently hauled to the site by the resident. As sites become farther removed from the generation centers, additional service for hauling the larger waste items will probably be financially feasible at least in the more affluent socio-economic areas. Since garbage disposal bins are available in these areas, many areas accept once-a-week collection as

adequate except for the need of disposal of larger items of waste. The feature most appreciated by citizens receiving twice-a-week collection is the added convenience of the service when a usual collection is missed.

Frequency of collection has previously been considered merely a public health problem; but with the somewhat recent concern about urban litter and indiscriminate dumping, some consideration should be given to the advantages that could accrue to the communities with twice-a-week collection service. As lifestyles change and residents move to urban areas of more affluent socio-economic levels, the necessary routine trips to refuse disposal sites become an unwholesome chore creating desires for better and more frequent service. It also appears that the urbanite accepts the rural attitude of self-sufficiency readily upon leaving the urban environment for a more rural area explaining, at least in part, public acceptance of dissimilar services in the County.

The major improvement required in collection systems is better enforcement of existing regulations, particularly pertaining to aesthetics. Unkept vehicles in need of paint are not uncommon due to both the need to keep vehicles "on the line" for economic reasons and the lack of sufficient enforcement personnel.

The San Bernardino County Code and State Waste Management Minimum Standards require refuse to be removed from all residences at least once each week. All food handling establishments must have refused removed at least twice each week. DEHS advocates a collection frequency of at least twice each week for all residences or businesses that are located in areas where continuing problems, such as fly breeding and odors, exist. However, each municipality and/or rural community must determine appropriate collection services within State Minimum Standards.

3. Disposal and Processing of Waste

There are 77 disposal facilities in the County, (some of are which inactive or closed at present), strategically located to accept disposal or transfer waste. The County has ownership or operational responsibility for 22 facilities

operating 15 landfills with County personnel; five landfills are operated by a private contractor; one landfill is operated by agreement with a city; and one transfer station is operated by a private contractor. Forty-nine (49) of the remaining 55 sanitary landfill facilities are owned and operated by private industry, 5 by military installations, and 1 by the City of Redlands. (Recent changes to this information indicates that the County has transferred its Needles landfill to the city, and there is a closed landfill site within the city of Upland.)

The sanitary landfill activity data of both publicly and privately operated facilities are included in Tables 7, 8, and 9. The two schematic maps (Figures 4 and 5) show the location of sites in the valley, mountain, and desert areas.

The County has awarded a landfill operation contract to operate and maintain four valley and one desert landfills, to include Milliken, Fontana, Colton, and San Timoteo (valley) and Phelan (desert). It should be noted that present plans provide for the closure of the Colton landfill, and for the County to take over operation of the Phelan landfill, both in the summer of 1988. This operation does not include the collection of gate fees at the valley landfills or the maintenance of scale facilities. Basically, the County pays the Contractor on a per ton basis for waste in-place at a minimum compaction density of 1,200 lbs. per cubic yard. The implementation of future alternatives to landfilling and resource recovery remains the responsibility of the County and the cities while fees may be adjusted by the County Board of Supervisors.

The Heaps Peak Transfer Station, located at the now closed Heaps Peak Sanitary Landfill site, is between Rim Forest and Running Springs Mountain Communities and immediately north of Highway 18 (Rim of the World). The facility serves all mountain communities surrounding the Lake Arrowhead area from Crestline on the west to beyond Running Springs in the east. The facility was opened in 1981 to receive and transfer the waste to the San Timoteo Landfill in the valley and is operated and maintained by contract with the County, which is financed by the revenue generated through annual assessment of land use fees to real property owners. This operation includes recycling of

DATA SHEET FOR WASTE OPERATIONS IN SAN BERNARDINO COUNTY

DUE DATES

LANDFILLS		RDSI	5 YEAR ENG. REV.	SWATS WATER	SWATS AIR	WASTE DISCH. UPDATE	CLOSURE	EXPANSION	COMMENTS	TRANSFER STA.
VALLEY SITES	CAJON	5-1-88		12-30-87	1-88				MAY BE REOPENED	
	COLTON			12-30-87	2-88		6-30-88		FINAL CLOSURE	
	FONTANA	8-1-88		12-30-87			6-30-89	6-30-89	EXPANSION MAY BE POSSIBLE	X
	MILLIKEN	10-1-88		12-30-87				X	PERMITTING FOR 30 AC. @ WEST END (EXPANSION?)	
	SAN TIMOTEO	9-1-88		7-1-88				X	80 AC. HAS BEEN PURCHASED FOR EXPANSION	
	YUCAIPA	7-1-89		7-1-88					MAY BE REOPENED	
MOUNTAIN SITE	BIG BEAR	4-1-88		12-30-87	3-88	4-1-88		X	LOWER SITE TO BE CLOSED UPPER SITE MAY BE EXPANDED OR CLOSED WITH TRANSFER	X
	HEAPS PEAK			2-2-88						
BA-II-D-85 DESERT SITES	APPLE VALLEY	7-1-88		2-10-88				X	EXPANSION PLANNED	
	BAKER						12-1-88		SMALL TRANSFER STATION PLANNED	12-1-88
	BARSTOW		2-1-89	2-29-88				X	480 AC. LEASED FROM BLM IN 1975 BUT NEVER PERMITTED	
	HESPERIA	6-1-88		7-1-88						
	LANDERS		3-1-88	7-1-88		3-1-88				
	LENWOOD — HINKLEY		5-1-89	2-29-88						
	LUCERNE VALLEY	12-1-88		7-1-88		4-30-89	X	X	MAYBE CLOSED, EXPANDED OR TRANSFERED	X
	MORONGO VALLEY		1-1-89	7-1-88		1-1-89				
	NEWBERRY						12-1-88		SMALL TRANSFER STA. PLANNED	12-1-88
	PHELAN	4-1-89		2-29-88						
	TRONA — ARGUS		6-1-89	7-1-88						
	TWENTYNINE PALMS	11-1-88		7-1-88		11-1-88				
	VICTORVILLE	3-1-89		2-29-88				X	EXPANSION PLANNED. LAND BEING ACCQUIRED	
	YERMO						12-1-88		SMALL TRANSFER STA. PLANNED	12-1-88
	PARKER						12-1-88		INTERIM CLOSURE BY BLM.	

SAN BERNARDINO COUNTY SOLID WASTE OPERATIONS
FEBRUARY 1988

Table 7

TABLE 8
SAN BERNARDINO COUNTY
SANITARY LANDFILL SITE
ACTIVITY SUMMARY
1988

Site Name	Location	Site Class	Site Acreage	Landfill Capacity (yd^3)	Remaining Capacity (yd^3)	Est. Life Expect.	Max. Depth of Fill	Paved Access Road	Owner	Site No.	Depth to Groundwater Table
1. Adelanto	D	III	60	1.4 million		Closed	N/A	Yes	C	1	230 ft.
2. Apple Valley	D	III	80	750 thousand	450 thousand	1995	N/A	Yes	C	2	38.0[6]
3. Baker	D	III	40	170 thousand	140 thousand	1989[7]	N/A	No	C	3	65 ft.
4. Barstow	D	III	160[3]	1.5 million	1 million	1997	45 ft.	Yes	C & B	4	900+[6]
5. Big Bear	M	III	58.6	675 thousand	75 thousand	1990	125 ft.	Yes	F	5	33.0[6]
6. Cajon, S.B.	V	III	106	3.9 million		Closed	40 ft.	Yes	C	6	267.3[6]
7. Colton	V	III	94	7.0 million	1.5 million	1988	80 ft.	Yes	C	7	14.3[6]
8. Daggett	D	III	80	2.6 million		Closed	N/A	No	C	8	280 ft.
9. Fontana	V	III	140	6.0 million	300 thousand	1989	40 ft.	Yes	C	9	317.2[6]
10. Heaps Peak[1]	M	III	63	2.5 million		Closed	N/A	Yes	C	10	7.4[6]
11. Hesperia	D	III	80	1.6 million	1.3 million	2005	N/A	Yes	B	11	150 ft.
12. Joshua Tree	D	III	25	250 thousand		Closed	20 ft.	Yes	C	12	150 ft.
13. Kramer Junction	D					Closed					
14. Landers	D	III	638[4]	11.5 million	11.0 million	2010	20 ft.	No	B	14	320 ft.
15. Lenwood-Hinkley	D	III	160	1.0 million	800 thousand	2010	35 ft.	Yes	C	15	75.3[6]
16. Lucerne Valley	D	III	19	100 thousand	5 thousand	1988	N/A	No	C	16	175 ft.
17. Milliken	V	III	196	11.2 million	1.3 million	1990	125 ft.	Yes	C	17	233.7
18. Morongo Valley	D	III	75	370 thousand	150 thousand	2000	50 ft.	Yes	C	18	180 ft.
19. Newberry	D	III	40	80 thousand	62 thousand	1989[7]	N/A	Yes	B	20	60 ft.
20. Parker Dam	D	III	40	40 thousand	4 thousand	1988	N/A	No	B	21	180 ft.
21. Phelan	D	III	80	750 thousand	576 thousand	2010	25 ft.	No	C	22	1000+[6]
22. San Timoteo	V	III	320+80	11 million	10.2 million	1995	N/A	Yes	C	30	80 ft.
23. Trona-Argus	D	III	48	300 thousand	130 thousand	2000	15 ft.	Yes	B	24	300 ft.
24. Twentynine Palms	D	III	70	660 thousand	300 thousand	2000	25 ft.	Yes	B	25	300 ft.
25. Victorville	D	III	80	1.7 million	1.0 million	1995	30 ft.	Yes	B	27	205.9[6]
26. Yermo	D	III	40	130 thousand	70 thousand	1989[8]	N/A	No	B	28	100 ft.
27. Yucaipa	V	III	560	500 thousand		Closed	200 ft.	Yes	C	29	550 ft.

[1] Transfer station became operational in 1981.
[2] Expanded in 1980.
[3] Additional 480 acres reserved for future regional site.
[4] Currently using 160 acres; balance reserved for future regional site.
[5] Interim closure by BLM
[6] From current water SWATS (others SWAT are not completed to date).
[7] Convert to Transfer Station.

Location
D = Desert
M = Mountain
V = Valley

Owner
B = Bureau of Land Management
C = County of San Bernardino
F = Us Forest Service

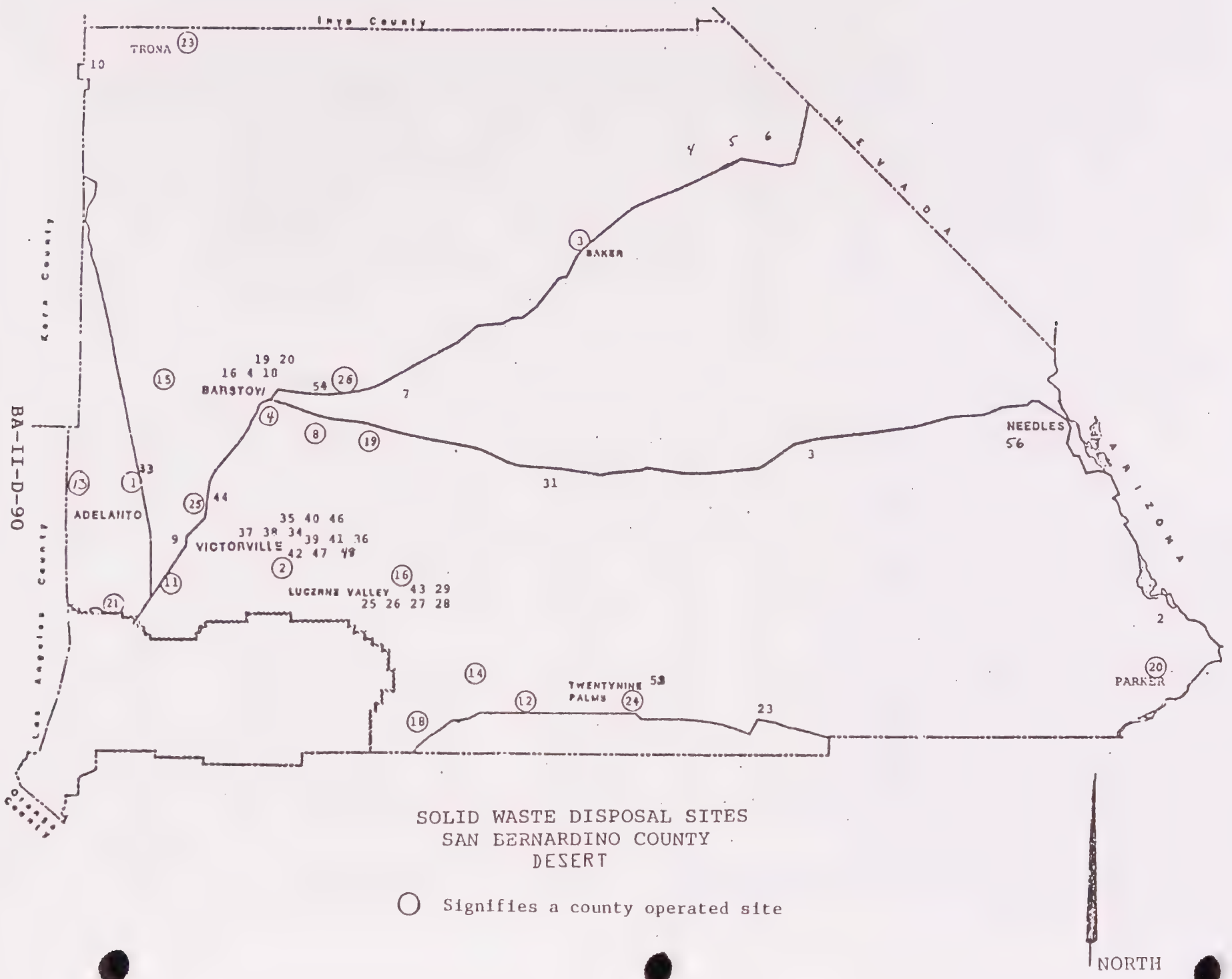
TABLE 9

NON-COUNTY DISPOSAL FACILITIES

MAP REFERENCE #	SITE NAME AND LOCATION	SITE CLASS	SITE ACREAGE	ESTIMATED LIFE	QUANTITY OF WASTE	OPERATOR
1	Agua Mansa Landfill, Rialto	III	58	1990	400 T/Dy	E.L. Yeager Construction Co.
2	Black Meadow Landing Resort	III	1	1983	Closed	Don Towning
3	Cal-Trans/Essex Disposal Site	III	1	1979	Closed	W.R. Green, Chief
4	Cal-Trans/Halloran Rest Area	III	1	1979	Closed	W.R. Green, Chief
5	Cal-Trans/Mountain Pass Disposal Site	III	1	1979	Closed	W.R. Green, Chief
6	Cal-Trans/Wheaton Rest Area Disposal Site	III	1	1979	Closed	W.R. Green, Chief
7	California Portland Cement/Baxter	III	N/A	2000+	5,000 T/Yr	California Portland Cement Co.
8	California Portland Cement/Colton	III	N/A	2000+	48,910 T/Yr	California Portland Cement Co.
9	California Portland Cement/Superior Site	III	N/A	2000+	5,000 T/Yr	California Portland Cement Co.
10	China Lake/E.O.D. #1 Disposal Site	III	1	2000+	2,000 T/Mo	Naval Weapons Center
15	City of Redlands/California Street Landfill	III	75	1993	90 T/Dy	City of Redlands
16	City of Barstow/Brine Spreading Area	III	29		Closed	City of Barstow
17	Conrock Claremont Disposal Site	Unclassified	118	2000+	N/A	Conrock Co.
18	Fort Irwin Road Solid Waste	III	20	2000+	60 G/Mo	A.T. & S.F. Railway Co.
19	Fort Irwin National Training Center Landfill	III	640	2006	25 T/Dy	Boeing Corp.
20	Goldstone Disposal Site	III	6	1988	10 T/Wk	U.S. Government/NASA
21	Holliday Sanitary Landfill, Rialto	III	40	1990	N/A	Frederick N. Holliday
22	Hubbs' West Seventh Street Disposal Site, San Bernardino	III	5	2000+	190CY/Mo	Donald C. Hubbs
23	Iron Mountain Pumping Plant Disposal Site	III	5	2000+	2 T/Wk	Metropolitan Water District of Southern California
24	Kaiser Steel Corp., Fontana	Unclassified	81	2000+	700 T/Dy	Kaiser Steel Corp.

MAP REFERENCE #	SITE NAME AND LOCATION	SITE CLASS	SITE ACREAGE	ESTIMATED LIFE	QUANTITY OF WASTE	OPERATOR
25	Kaiser/Gypsum Cushenberry, Lucerne Valley	III	5	2000+	1 T/Dy	Kaiser Cement & Gypsum Corp.
26	Kaiser/Gypsum Ground Raw Materials, Lucerne Valley	III	50	2000_	4,500 G/Dy	Kaiser Cement & Gypsum Corp.
27	Kaiser/Gypsum Dust Dump, Lucerne Valley	III	40	2000+	15 T/Dy	Kaiser Cement & Gypsum Corp.
28	Kaiser/Gypsum Marble Canyon, Lucerne Valley	III	N/A	N/A	N/A	Kaiser Cement & Gypsum Corp.
29	Kaiser/Gypsum Stripping Tailings, Lucerne Valley	III	N/A	N/A	N/A	Kaiser Cement & Gypsum Corp.
30	Laird Construction Co., Montclair	III	5	2000+	N/A	Laird Construction Co.
31	Ludlow Solid Waste Disposal	III	14	2000+	2 T/Dy	Knoll, Inc.
32	Montecito Memorial Park, Colton	III	250	2000+	3CY/Wk	Montecito Memorial Park
33	Munitions Residue Disposal Site, George AFB	III	3	1990	150CY/Mo	35th Civil Engineering AF Squadron
34	Oro Grande/Alkali Dust Disposal Site	III	104	2000+	200 T/Dy	Riverside Cement Co.
35	Oro Grande/Mack's Peak Waste Disposal Site	Unclassified	14	2000+	1,800,000 T/ Capacity	Riverside Cement Co.
36	Oro Grande Original Canyon Quarry Waste Dump	Unclassified	4	2000+	600,000 T/ Capacity	Riverside Cement Co.
37	Oro Grande Sanitary Landfill	III	104	2000+	10 T/Dy	Riverside Cement Co.
38	Oro Grande Shay/Klondike Waste Disposal #1		104	2000+	200 T/Dy	Riverside Cement Co.
39	Oro Grande Shay/Klondike Waste Disposal #2	Unclassified	7.5	1990	200,000 T	Riverside Cement Co.
40	Oro Grande Sparkuhle Disposal #1	Unclassified	51	2000+	7,000,000 T/ Capacity	Riverside Cement Co.
41	Oro Grande Sparkuhle Disposal #2	Unclassified	20	2000+	1,500,000 T/ Capacity	Riverside Cement Co.
42	Oro Grande Sparkuhle Disposal #3	Unclassified	39	2000+	5,000,000 T/ Capacity	Riverside Cement Co.
43	Pfizer Lucerne Valley Disposal Site	III	23	1993	45,000 T/Yr Avg 38,000 100 T/Dy	Pfizer, Inc.
44	Pfizer Victorville Disposal Site	III	6.5	1988	8 T/Dy	Pfizer, Inc.
45	Rialto Landfill	III	3.6	2000+	5 T/Dy	City of Rialto

MAP REFERENCE #	SITE NAME AND LOCATION	SITE CLASS	SITE ACREAGE	ESTIMATED LIFE	QUANTITY OF WASTE	OPERATOR
46	Scheerer Quarry Waste Site #1, Victor Valley area	Unclassified	3.5	1985	200,000 T/ Capacity	Riverside Cement Co.
47	Scheerer Quarry Industrial Waste Site #2, Victor Valley area	Unclassified	10	2000+	500,000 T/ Capacity	Riverside Cement Co.
48	Scheerer Quarry Industrial Waste Site #3, Victor Valley area	Unclassified	23	2000+	1,600,000 T/ Capacity	Riverside Cement Co.
49	Livingston-Graham, Redlands	III	5	1985	900,000 G/Mo	Livingston-Graham
50	Upland Landfill	III	34	1979	In Process of Closing	C.V. Disposal
51	Upland Rock Plant/Reclamation Fill	Unclassified	3	2000+	100CY/Dy	Sully-Miller Contracting Co.
53	U.S. Marine Corps Disposal Site/ Twentynine Palms	III	73	2000+	250CY/Dy	U.S. Marine Corps.
54	U.S. Marine Corps Disposal Site/ Yermo Activity	III	17.4	1992	60 T/Dy	U.S. Marine Corps Logistics
55	Western Refuse Transfer Station, Chino	III	1	2000+	2 T/Dy	Western Refuse Hauling
56	City of Needles	III	160	2010		City of Needles



SOLID WASTE DISPOSAL SITES
SAN BERNARDINO COUNTY
DESERT

○ Signifies a county operated site

Figure 4

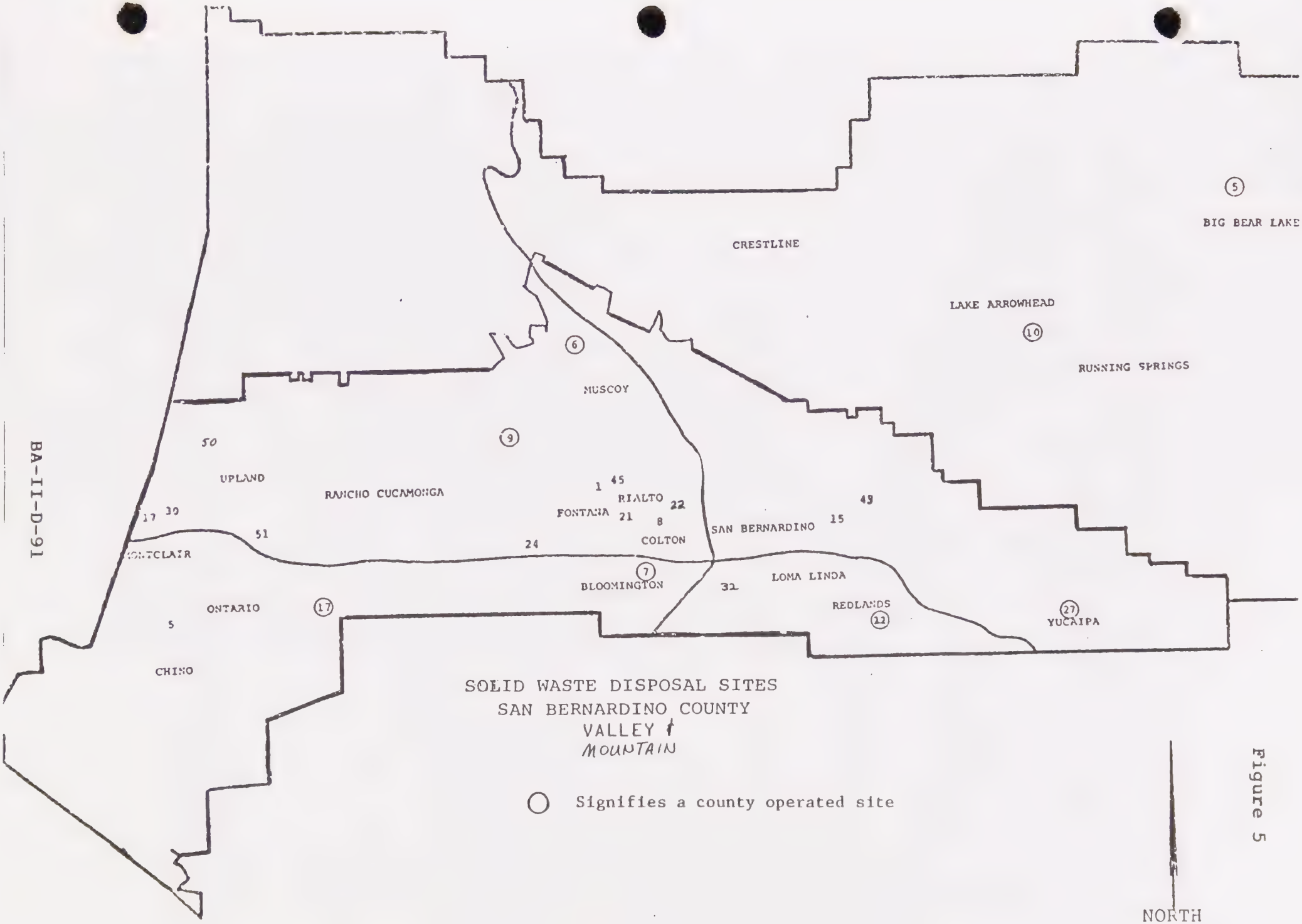

BA-II-D-91
BIG BEAR LAKE
CRESTLINE
LAKE ARROWHEAD
RUNNING SPRINGS
MUSCOY
UPLAND
RANCHO CUCAMONGA
FONTANA
RIALTO
COLTON
SAN BERNARDINO
LOMA LINDA
REDLANDS
YUCAIPA
BLOOMINGTON
ONTARIO
CHINO
SOLID WASTE DISPOSAL SITES
SAN BERNARDINO COUNTY
VALLEY
MOUNTAIN
Signifies a county operated site
NORTH

Figure 5

materials, and revenue is donated to a Parks and Recreation entity serving the mountain communities.

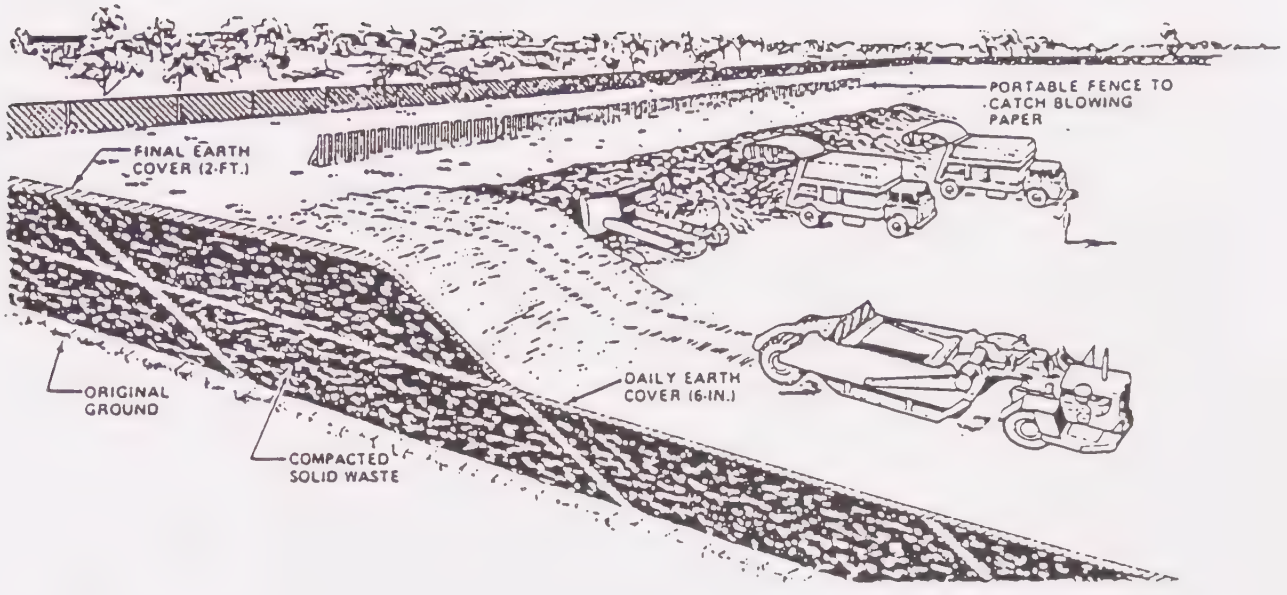
The City of Needles assumed the operational, maintenance, and closure responsibilities of the Needles Landfill Site in 1987 from the County.

The County provides evaporation ponds for the disposal of septic tank pumpings at seven of the desert sites. This disposal method is planned to continue until the regional wastewater treatment plants can accept these wastes.

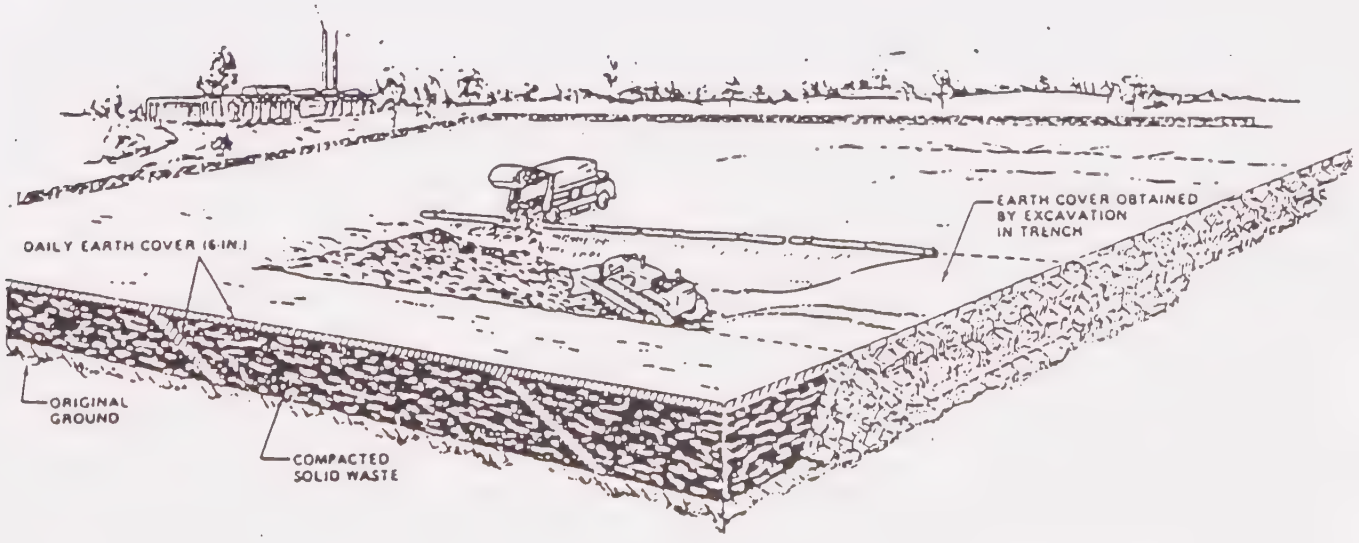
Sanitary landfill operations generally consist of spreading waste materials over a prescribed area of land, compacting it to its smallest practical volume and covering it with soil at the end of each working day in a manner established by the California Waste Management Board regulations and standards.

The County Solid Waste Management operation uses different methods of operating a sanitary landfill: area, cut and cover, and trench. The area method is very suitable in mountainous terrain where the landfill is constructed in canyons, but cover materials are necessarily imported from the immediate vicinity. The cut and cover method is generally practiced together with trenching in the desert. The trench method which requires double handling of material makes the cost of operation more expensive than cut and cover. The valley sites utilize a combination trench and area method which is the most economical method where land values are high. The trench method allows more wastes to be landfilled per unit area of land. Figure 6 shows the area and trench methods.

Waste is received at the landfill or transfer facilities from packer trucks, open-bed trucks, pickup trucks, trailers, or small loads in passenger vehicles. The vehicles are properly directed to operating tables of the landfill whereby waste is unloaded by the hauler. The landfill equipment removes the waste from the operating table and it is worked generally onto an incline of three horizontal to one vertical slope in layers of about two-feet thick with heavy equipment (compactors and track type tractors). The specially equipped compactors and dozer tractors pass over the waste four to five times to attain proper compaction before adding another layer. At large sites, cover material is spread over the waste at



AREA METHOD. The bulldozer spreads and compacts solid wastes. The scraper (foreground) is used to haul the cover material at the end of the day's operations. Note the portable fence that catches any blowing debris. This is used with any landfill method.



TRENCH METHOD. The waste collection truck deposits its load into the trench where the bulldozer spreads and compacts it. At the end of the day the dragline excavates soil from the future trench: this soil is used as the daily cover material. Trenches can also be excavated with a front-end loader, bulldozer, or scraper.

the end of the workday from top to bottom of the working face by use of earth moving equipment (scrapers). When cover material is imported, it is stockpiled at the top of the working face to avoid conflict with refuse vehicles at the bottom of the working face. However, cut and cover operations may move cover material from the bottom of the working face where it is generated up the working face by using the same dozer as for landfilling.

Blown litter is significantly reduced by drifting cover materials downslope with a bulldozer and feathering it as the equipment moves. A cell of refuse, which is surrounded on all sides by soil is constructed at the end of each working day. The refuse unloading - spreading and compacting-soil covering cycles are repeated until the final finish landfill grade is attained.

Septic tank pumpings and other State approved liquid wastes are disposed of into evaporation field ponds. Some of these are located within selected sanitary landfill perimeters.

The types of wastes that may be discharged into a sanitary landfill are prescribed and regulated by the State of California Water Resources Control Board through its respective Regional Water Quality Control Board's offices. (Santa Ana Region, Lahontan Region, and Colorado River Basin Region.)

San Bernardino County Landfills are Class III, indicating the ability of individual site factors to protect water quality. Artificial barriers and diversion channels for protection against a 100-year flood frequency are provided as necessary to protect the environment. Group III wastes generally consisting of chemically or biologically decomposable materials, which do not include hazardous and toxic substances or any materials capable of significantly impairing the quality of usable water, are permitted to be discharged subject to explicit and site specific requirements.

4. Sanitary Landfill Facilities: Current Considerations

Current considerations in the County's provision of sanitary landfill facilities include the possible reopening of previously closed facilities, expansion of existing facilities, consolidation of marginal landfills in close proximity, new transfer stations, and the possibility of new landfill sites being established in canyon areas of the valley.

The County's Cajon and Yucaipa Sites, which ceased landfill activities in 1980, are now being considered for reopening in the near future. San Timoteo Sanitary landfill, which was completed in 1980, was intended to serve as a regional landfill for the East San Bernardino County Valley areas. However, the City of Redlands is also considering expansion of the City operated landfill and sewer treatment facility which will temporarily reduce the waste load into the San Timoteo Landfill Site.

Because of increasing environmental constraints and institutional restrictions, the Heaps Peak Sanitary Landfill was replaced by a transfer station utilizing large 40 ton gross vehicle weight tractor-trailers to haul the waste generated in this area to the San Timoteo and Fontana Sites.

The Big Bear Sanitary Landfill has been closely examined for replacement, closure, or continuation of disposal activity. The lower Big Bear disposal site has been closed due to a California Water Quality Control Board's Cease and Desist Order. Closure of this area will be completed in late 1989.

Alternatives to landfilling in the Big Bear Valley were considered in a Regional Comprehensive Solid Waste Management Plan in 1984. The Plan evaluated high quality incineration and transfer stations as options but were found to be economically and/or technically unviable at that time. However, these options are being further studied.

The Black Meadow Landing Resort has ceased disposal operations at their landfill and have engaged the collection services of a local hauler to collect the resort waste and haul to the Colorado River Indian Tribe Site on the Arizona side of the River north of Parker, Arizona.

The Havasu Landing Community has indicated the intention to develop a landfill site or possibly a mini-transfer station with the waste being hauled to the Needles Disposal Site. The community continues to suffer from the inability to finance an adequate system that would be commensurate with their financial resources.

Increased costs of landfill operations because of high cost of fuel, equipment, maintenance, labor, and attempts to upgrade sites to meet Resource Conservation and Recovery Act (RCRA) Standards is forcing the County to look for various ways to improve efficiency of waste disposal operations in the desert areas. One alternative being proposed is to consolidate marginal and adjacent landfill sites without creating untenable adverse social and economic impacts on the communities being served by the respective sites. Initial implementation of this concept will involve Baker, Yermo, and Newberry communities where mini-transfer stations may be evaluated with waste being transferred to the Barstow Sanitary Landfill.

Another area that is being investigated for a mini-transfer station is Lucerne Valley. Preliminary evaluation indicates substantial landfill operation cost savings may be realized if all wastes generated at Lucerne Valley are transferred to the Apple Valley Sanitary Landfill. Because in rapid population growth in the area, the Apple Valley Site will have to be expanded in the future.

Parker Sanitary Landfill was identified as a marginal site, accepting only about 3,200 cubic yards of refuse per year. The volume reduction was a result of a contract negotiated in 1982 with the Colorado River Indian Tribe to accept the transfer of Group III wastes from the Parker Area for disposal at their landfill located north of Parker, Arizona. Interim closure activities are being planned for the site under the auspices of the Department of Interior's Bureau of Land Management.

The Victorville Landfill, which serves mainly the Victorville-Adelanto areas, may be expanded in the future. The United States Department of the Air Force has also indicated intentions to establish a Class I and a Class III sanitary landfill site for exclusive use of military installations. The

existing Class III landfill in Fort Irwin is also proposed to be expanded.

A preliminary landfill siting study was conducted by consultants (SCS Engineers) for the valley area. This study identified an area surrounding the valley for consideration to site possible future landfills. Five sites were selected as potentially worthy of further investigation; the report states that each of the five candidate landfill sites can be designed and operated in a manner which will protect the environment. The report further states that strong opposition from nearby urbanized areas can be expected. The five candidate sites are:

- Duncan Canyon, north of 15 Freeway and west of Lytle Creek
- Morton Canyon, north of Mentone and west of the Santa Ana River
- East Fork of Devil Canyon, northwest of California State University at San Bernardino campus
- Cleghorn Canyon, north of Cajon campground and east of Lost Lake and the 15 Freeway
- Sycamore Canyon, northwest of 15 Freeway near Glen Helen Regional Park

Figure 7 indicates the area surrounding the valley in which the above five candidate sites are located. Figures 7 and 8 also indicate existing county landfills and highlight those with potential for facilities expansion or reopening as discussed in this section of the report.

5. Routine Landfill Maintenance Operations

The operation of any sanitary landfill inherently disturbs the immediate environment. Routine maintenance is intended to reduce the negative impacts thereof, including periodic drainage control, structure maintenance and repairs, blown litter pickups within the landfill and its environs, leachate collection and disposal, and landfill slope stabilization and repair.

SAN BERNARDINO COUNTY SANITARY LANDFILLS AND POTENTIAL AREAS FOR SOLID WASTE FACILITIES

VALLEY AND MOUNTAIN AREAS

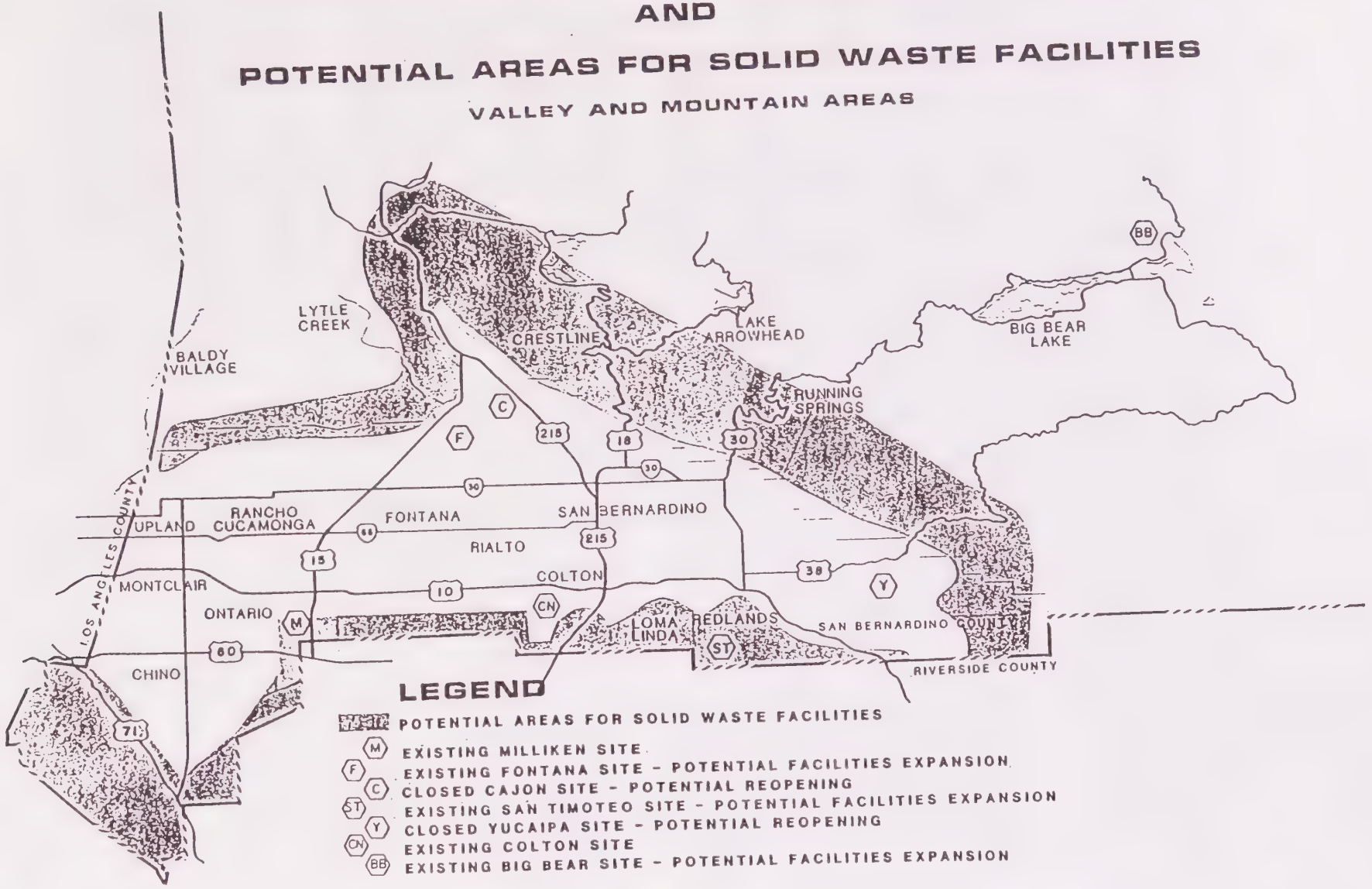
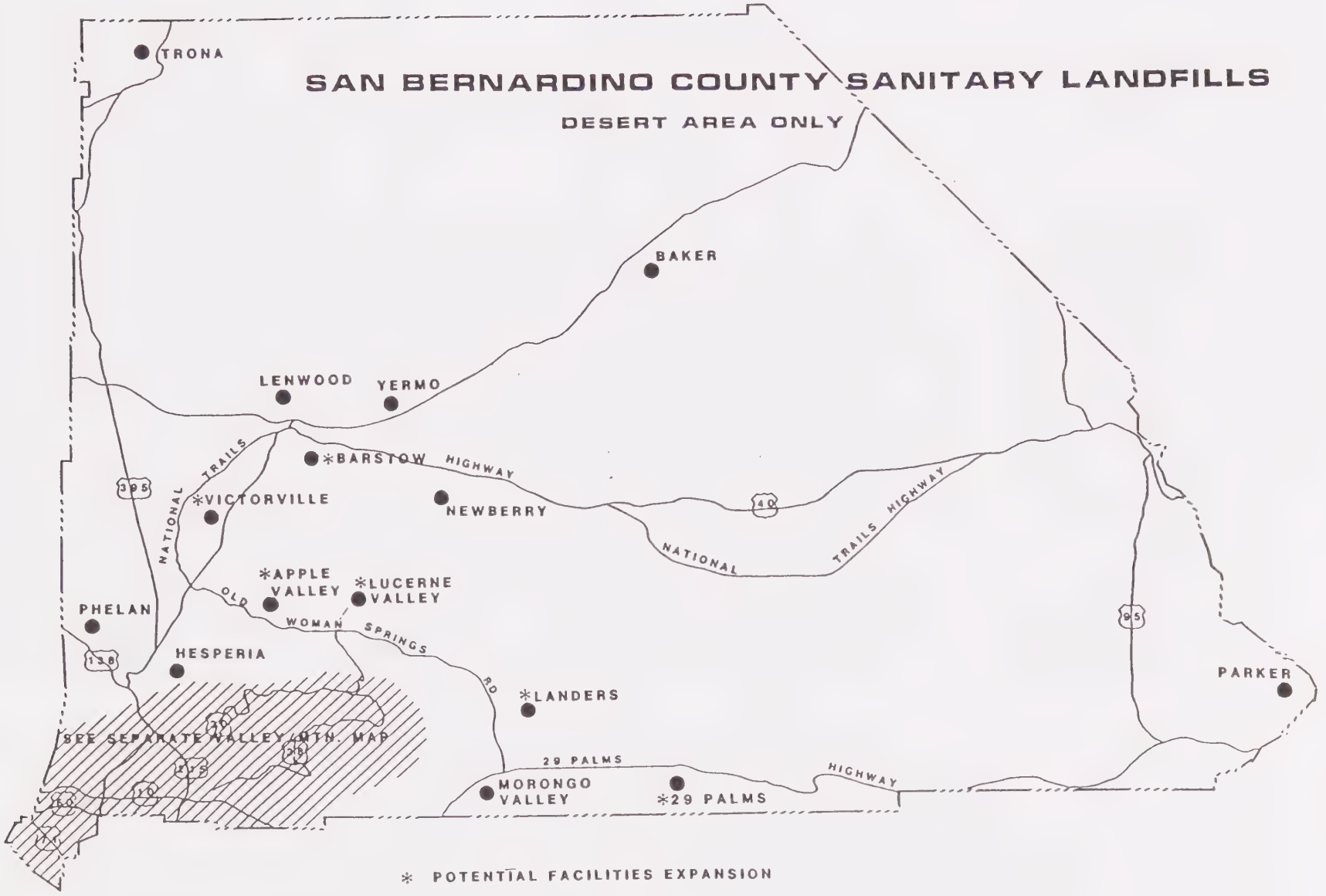


Figure 7



BA-II-D-99

Figure 8

Closed landfill sites are inspected at least semi-annually to identify required maintenance, such as proper drainage, regrading of final cover to preclude ponding, etc. Timely corrective measures prevent further deterioration of the facility. Proper maintenance and grading of settlement depressions are essential to prevent leachate production.

6. Special Wastes: Asbestos

Although listed as a hazardous waste in the State's Hazardous Waste Control Law, asbestos can be deposited at any Class III Landfill which has been approved to accept asbestos. Unlike most all other types of hazardous waste, asbestos is non-mobile once it is buried and, therefore, does not threaten groundwater. Because it is a hazardous waste, it must be accompanied by a Uniform Hazardous Waste Manifest document and must be hauled by a licensed hazardous waste hauler. When the asbestos arrives at the landfill site, a separate pit must be excavated and once in the pit, the asbestos must be covered immediately. Asbestos waste production in San Bernardino County was as follows in the early 1980's (more recent information is not available at this time):

1982: 24,020 Pounds
1983: 175,080 Pounds
1984: Unknown At This Time

7. Revised Water Quality Regulations Under Subchapter 15

The California Water Quality Control Board adopted revised regulations (Title 23, Subchapter 15, California Code of Regulations) October 18, 1984 which affect sanitary landfill disposal of water discharge to land. These revised Regulations, which became effective November 26, 1984, establish waste and site classifications including waste management requirements for waste treatment, storage or disposal in landfills, surface impoundments, waste piles, and land treatment facilities. The requirements are considered to be minimum standards for proper management of each waste category. Regional Boards, however, may impose more stringent requirements to accommodate regional and site specific conditions. In general, the revised regulations require more stringent monitoring programs in order to preclude the

discharge of leachate to surface or underground water. The existing landfill facilities waste discharge requirements will be reviewed in accordance with schedules to be established by the Regional Boards. In no instance shall such review be beyond five years of the effective date of the revised regulations. The waste discharge requirements will be revised to incorporate reclassification and retrofitting requirements, as well as the revised monitoring program to be utilized. The Regional Board will specify in the waste discharge requirements, the schedule for retrofitting of existing facilities to be accomplished within five years from the issuance of these revisions which may specify closure and post closure maintenance criteria. Depending upon geologic conditions and the potential for surface or groundwater contamination, landfill facilities. may be required to have extensive liner protection with leachate collection and treatment systems together with impermeable final cover to minimize the production and migration of leachate.

8. Maintenance of Land Use Compatibility

The County Solid Waste Management Master Plan has been referenced in the San Bernardino County Consolidated General Plan to assure continued compatibility of land uses with those proposed or occurring adjacent to, or in the proximity of, solid waste facilities. Land use planning requires consideration of the General Plan and solid waste facility sites shall also be considered for consistency with the General Plan. Any revisions of the County Solid Waste Management Master Plan will also be included as amendments to the General Plan.

The operation of solid waste facilities has been discussed in the text of the CoSWMP. Site designation on City and County General Plan maps are required to insure that their locations and existence are clearly delineated and recognizable so all future land use descriptions and decisions are made with full knowledge that these facilities exist. The critical need to preserve the continued existence and unhampered use of as many solid waste facility sites as possible is recognized.

When a General Plan Amendment is being considered pertaining to the vicinity of a solid waste facility site which may affect or be affected by the

allowable land uses, such action shall carefully consider the compatibility of the potentially allowable or allowed uses on adjacent or nearby land. Compatible uses with the existing and/or proposed solid waste facility sites must be identified.

The following potential negative impacts are the minimum to be considered when evaluating the compatibility of proposed changes in land uses adjacent to a solid waste facility:

Traffic	Litter	Gas Migration
Dust	Fires	Water Quality
Vectors	Explosions	Existing Land Uses
Rodents	Odors	Air Quality
Drainage	Noise	

The following are examples of land uses which are particularly sensitive to negative impacts from solid waste facilities which, therefore, should not be build adjacent to, or in the vicinity of, solid waste facilities:

Single and Multi-Family Dwellings
Commercial Establishments
Mobile Home Projects
Schools
Airports
Churches
Hospitals, Including Rest Homes and Guest Homes
Public Meeting Places
Child Nurseries
Medical Offices
Residential Care Homes
Restaurants and Bakeries
Public Recreation Facilities
Business Offices
Other Similar Activities

In addition, proposed landfill sites should not be identified near these or similar activities. Additionally, there are many other types of land uses which are sensitive to potential negative impacts from solid waste facilities and should be established on appropriately zoned areas, preferably at an acceptable distance from any solid waste site. Hence, local governmental agencies which are responsible for land use planning and zoning must be aware of, and consider the consequences of, land use decisions pertaining to existing

solid waste facilities or upon properties adjacent to a proposed solid waste facility.

Some potential negative impacts can be mitigated in certain instances by terrain barriers, appropriate building setbacks, or structural improvements either to the solid waste facility or adjacent property uses. If potential negative impacts cannot be acceptably mitigated, the proposed land use must be considered incompatible.

The California Government Code Section 66784.1(c) states, "A City or County shall not authorize land uses adjacent to or near a site for any solid waste facility designated in the applicable city or County General Plan if the land use would restrict or preclude the establishment of a solid waste facility or expansion of the facility or site." This provision of the legislation is designed specifically to prevent encroachment of incompatible land use on solid waste facilities.

9. Enforcement Program

The State Solid Waste Control Act requires each County in California to designate a Local Enforcement Agency (LEA). In December 1978, the County Board of Supervisors designated the Department of Environmental Health Services (DEHS) as the LEA for this County. This designation was subsequently approved by the California Waste Management Board in January 1979 and in September 1981, DEHS submitted the Local Solid Waste Enforcement Agency Program Plan as required by Code to the California Waste Management Board.

The duties and activities of the LEA for the Solid and Liquid Waste Management Section of DEHS consist of routine inspections of refuse vehicles, disposal sites, and other waste facilities under permit to the Department; assist in County-wide and regional studies and surveys on storage; collection and disposal of waste; and enforce minimum standards and investigate health-related problems associated with waste management. In addition, this Section administers the County Refuse Disposal Advisory Council; serves as staff to the County Solid Waste Advisory Council; maintains inventories and records on all phases of waste management; investigates citizen complaints; consults with other entities concerned with waste management; reviews waste disposal facilities

construction and operation plans; cooperates with the California Waste Management Board and State Department of Health Services in developing and enforcing standards for waste handling; conducts a program of inspection, education, and enforcement to bring about progressive reduction and elimination of insanitary conditions related to waste management including litter control and resource recovery; and administers the County's Refuse Collection Rate Adjustment Policy.

10. Regulatory Agencies

Regulatory agencies are those Federal, State, and local organizations charged with protection of public health and the use, control, maintenance, and/or protection of the land, water, and air as mandated by law and applicable to solid waste management systems. The regulating agencies are as follows:

- State Department of Health Services
- California Waste Management Board
- San Bernardino County Department of Environmental Health Services (DEHS)
- U.S. Forest Service
- South Coast Air Quality Management District
- San Bernardino Air Pollution Control District (part of DEHS)
- California Regional Water Quality Control Boards

    a. Lahontan Region
    b. Santa Ana Region
    c. Colorado River Basin Region

- Bureau of Land Management
- City and County Planning Commissions

11. State and Local Regulations

In San Bernardino County, DEHS operates by authority of Title 7.3 of the Government Code and Title 14 of the California Code of Regulations. In the unincorporated area of the County, the Solid Waste Standards are located in the San Bernardino County Code, Title 3, Section 33.021, et. seq. In addition to the regulations and codes cited above, the following Cities have their own local city ordinances which regulate the storage, collection, and disposal of solid waste.

City of Adelanto
City of Barstow
City of Chino
City of Colton
City of Fontana
City of Twentynine Palms
City of Loma Linda
City of Montclair
City of Needles
City of Ontario
City of Redlands
City of Rialto
City of San Bernardino
City of Upland
City of Victorville

The following Cities have adopted the County Code as their ordinances which regulate the storage, collection, and disposal of solid waste.

City of Big Bear Lake
City of Grand Terrace
City of Rancho Cucamonga

12. Solid Waste Facility Permitting Procedures

San Bernardino County follows the permitting procedures detailed in Article 2, Chapter 3, Title 7.3, Government Code, and Article 3, Chapter 5, Division 7, Title 14, California Administrative Code.

Permits for solid waste facilities are based upon information provided in the prospective solid waste facility operator's permit application. The submitted information is reviewed by staff and verified during facility inspections. Using the California Waste Management Board's format, a proposed permit is then prepared.

After preparation, the permit is submitted to the California Waste Management Board for concurrence and a copy is forwarded to the applicant for review and comment. Uncontested permits are issued by the LEA within the time required by law.

If the proposed permit is denied, the applicant may file an appeal with the LEA who shall then submit the appeal to the Hearing Panel. After a hearing, the decision of the Hearing Panel is the basis for an action by the LEA. All appeal procedures shall be carried out in strict compliance with Title 7.3, Government Code, and the Administrative Procedure Act. Figure 9 graphically depicts the solid waste facility permitting process.

Permits are revised whenever a significant change in facility design or operation is proposed by the

SOLID WASTE FACILITY PERMITTING PROCESS

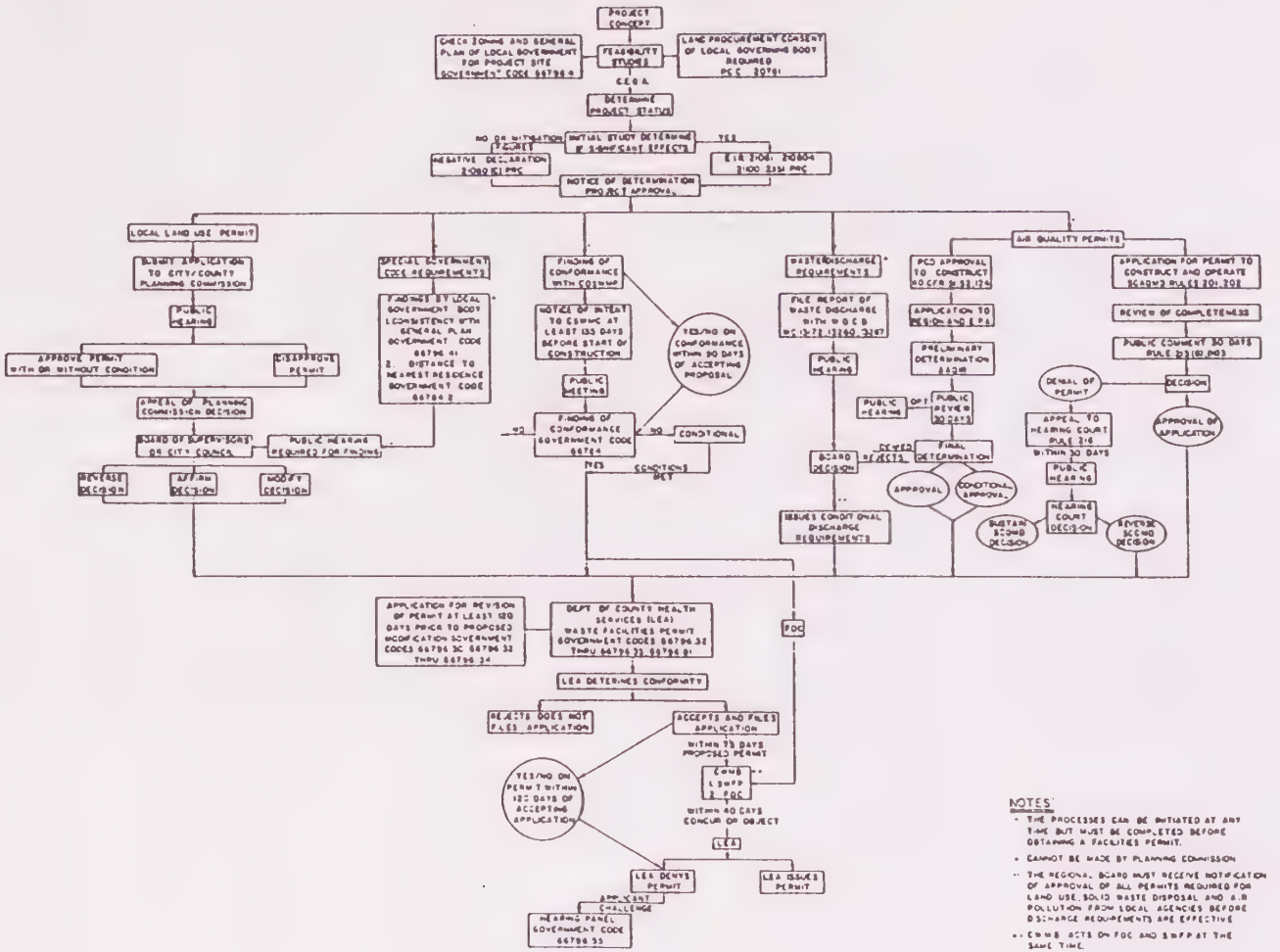


Figure 9

operator, i.e., site expansion, types of wastes that may be received, etc.

Permits are modified when it has been determined that an existing permit no longer provides pertinent data in the findings, in the conditions, or in the monitoring data that is necessary for the protection of the public or the environment.

When the LEA becomes aware of a proposed solid waste facility closure, written notification is given the disposal site operator and owner of the closure procedures and requirements. After closure, the site is periodically monitored to identify violations that may develop and abated as required.

13. Inspection and Compliance Procedures

All solid waste collection and hauling vehicles are inspected annually. The results of these inspections are furnished the owners. Company files are maintained in the County's Central Office.

Solid waste disposal and transfer facilities are inspected a minimum of twice per year. Prior to an inspection, the facility permit, all correspondence, and last inspection records are reviewed. After the inspection, a written report is prepared and sent to the operator and a copy of each inspection is forwarded to the California Waste Management Board. The inspection sheets are filed in the facility files. Records of individual facility files are established for each permitted facility and contain correspondence, inspection records, facility application, etc.

Compliance procedures are as follows:

- **Verbal Notice:** To storage, collection, or facility operators at the time that a violation is identified.
- **Written Notice:** Usually transmitted by mail; may be issued by the field investigator at the scene of the violation.
- **Office Hearing:** Administrative hearings providing the violator an opportunity to present evidence of compliance to avoid further enforcement procedures.

- **Notice of Violation:** Prepared and transmitted to the operator. A copy of the Notice is transmitted to the California Waste Management Board. Compliance or non-compliance with a Notice of Violation is determined by inspection.

Written or verbal complaints that are the source of health or environmental hazards or a public nuisance are accepted and investigated. Anonymous complaints are investigated only when the probability of immediate health or safety hazard is apparent. Complaint and investigation results are recorded on the Department report form. Verified complaints result in the issuance of an abatement order. The results of the investigation may be provided the complainant by mail or telephone..

Glossary

automobile shredded waste (fluff) - the material remaining once metallic articles, such as auto bodies, appliances and sheet metal, are shredded and the metal is removed.

cell - that portion of compacted solid wastes in a landfill that is enclosed by natural soil or cover material during a designated period.

CoSWMP - County Solid Waste Management Plan.

DEHS - San Bernardino County Department of Environmental Health Services.

garbage - all kitchen and table food waste, and animal or vegetable waste that attends or results from the storage, preparation, cooking or handling of food stuffs.

landfill - a disposal site employing a method of disposing of solid wastes on land without creating nuisances or hazards to public health or safety, by utilizing principles of engineering to confine the wastes to the smallest practical area to reduce them to the smallest practical volume, and to cover them with a layer of suitable cover materials at specific designated intervals (see also Sanitary Landfill).

LEA - Local Enforcement Agency

leachate - liquid that has come in contact with or percolated through waste materials and has extracted or dissolved substances therefrom.

litter - all improperly discarded waste material, including, but not limited to, convenience flood, beverage, and other product packages or containers constructed of steel, aluminum, glass, paper, plastic, and other natural and synthetic materials, thrown or deposited on the lands and waters of the state, but not including the properly discarded waste of the primary processing of agriculture, mining, logging, sawmilling, or manufacturing.

refuse - garbage and rubbish.

recycling - the process by which salvaged materials become usable products.

resource recovery - the reclamation or salvage of wastes for

reuse, conversion to energy or recycling.

rubbish - non-putrescible solid wastes such as ashes, paper, cardboard, tin cans, yard clippings, wood, glass, bedding, crockery, plastics, rubber by-products or litter.

sanitary landfill - a disposal site employing an engineered method of disposing of solid wastes in a manner that minimizes environmental hazards by spreading, compacting to the smallest practical volume and applying cover material over all exposed wastes at the end of each operating day (see also Landfill).

sludge - the accumulated solids and/or semisolids deposited from wastewaters or other fluids.

solid waste management - a planned program for effectively controlling the generation, storage, collection, transportation, processing and reuse, conversion or disposal of solid wastes in a safe, sanitary, aesthetically acceptable, environmentally sound and economical manner. It includes all administrative, financial, environmental, legal and planning functions as well as the operational aspects of solid waste handling, disposal and resource recovery systems necessary to achieve established objectives.

TRANSPORTATION/CIRCULATION

TRANSPORTATION/CIRCULATION

I. INTRODUCTION

The General Plan Circulation Element, required by state law since 1955, is intended to serve not simply as a transportation plan. It is meant to serve as an infrastructure plan which concerns itself with the circulation of people, goods, energy, water, sewage, storm drainage, and communications. The main focus of this section of the background appendix will be on the circulation of people and goods in the unincorporated portions of San Bernardino County in which the County has jurisdiction. The circulation of water, sewage, and storm drainage has been addressed in other sections of the background appendix (Water Distribution Systems, Wastewater Distribution and Collection Systems, and Flood Hazards/Flood Control).

San Bernardino County has a transportation system which is intended to satisfy the needs of a population that has a lifestyle typified by a high degree of mobility. The demand for movement of people and goods is met by both private and public means. Transportation facilities which respond to the need of San Bernardino County citizens include state freeways and highways, local arterial highways, bikeways, transit, rail (freight and passenger), and aviation (military, commercial and general aviation). The County is not directly responsible for the planning and implementation of all of the various transportation facilities but is affected by and cooperates with various federal, state, regional and local agencies, including: Federal Highway Administration (FHWA); State of California Department of Transportation (Caltrans); Southern California Association of Governments (SCAG); San Bernardino Associated Governments (SANBAG), which acts as the County Transportation Commission; San Bernardino County Department of Transportation/Flood Control; and various municipalities. The County routinely interacts with agencies that develop freeways and provide transit service in order to assist and support them in their planning and implementation efforts.

The vast majority of travel trips in San Bernardino County are made by automobile, using the extensive network of freeways and arterial highways. Transit service is also an increasingly important mode of transportation in the more urban areas of the County. Transit provides mobility to many individuals in the County who depend on it for traveling to and from work and school, and for other important travel needs. A small fraction of the trips are made utilizing other modes of transportation such as air, rail, bicycling and walking.

The current transportation conditions are directly related to a combination of economic events and social changes that have occurred over the past 10 to 20 years. San Bernardino County has grown from a collection of small cities and unincorporated communities with an agrarian economic base to an area with various centers of economic activity and a large and affluent population. The rapid growth in employment and population has increased the number of trips made on the freeway and arterial highway systems. This intense travel demand has impacted levels of service on significant portions of the system, causing severe congestion and low travel speeds during peak hours in the rapidly developing Valley and Mountain areas, and also in the Victor Valley area of the Desert.

Current transportation conditions are also directly related to the issue of funding for required highway and road improvements. The early 1980's saw massive layoffs in the County of San Bernardino's Department of Transportation and Flood Control, as well as a reduction in the level of maintenance of the County maintained road system and the cessation of road building and improvements.

The cost for new facilities is one issue; conversely there are costs of congestion when required facilities or measures are lacking. Congestion costs individuals, firms, and ultimately, society. Time spent waiting in cars and trucks is time lost, whether waiting in traffic, for staff, or deliveries. Various measures have been taken or are being considered since Proposition 13 to relieve congestion and provide for needed roads, including developer-built roads, road fees, a one-half cent sales tax in San Bernardino County, and toll roads are being considered in Orange County.

Within the County's Valley area transportation is based largely upon a reliance on the automobile. A significant proportion of Valley residents commute daily into Los Angeles and Orange Counties by automobile; SCAG forecasts increases in home-to-work trips from San Bernardino County to Los Angeles and Orange Counties of 146% and 272% respectively from 1984 to 2010.

Except for ride-sharing and limited bus services, there are presently no viable transportation alternatives. Similarly, residents of both Orange and Los Angeles Counties frequently travel to the Valley for recreational events, leisure activities or to use Ontario Airport. The widespread dependence on the automobile contributes to congestion and air pollution and, in times of energy shortages, could seriously restrict mobility.

Consequently, it is important that design and construction of

roadways in the numerous Valley cities and unincorporated communities are linked to form a coordinated and integrated Valleywide transportation system. This is particularly critical in avoiding circumstances where some roadways are congested and others are underused. It is also critical to maintain close ties with local streets, State highways and freeways to avoid premature decisions on land use commitments. Although public transit is now available in many areas of the Valley, continued analysis of routes and schedules is essential to achieve maximum efficiency and utilization from the large capital investment.

The County's Mountain region is served by a limited number of roads which frequently climb steeply and curve sharply over a difficult landscape. Engineering and construction of new roads or improvement of existing roads can be very costly and time consuming. In several Mountain communities the existing roadways are already severely overcrowded and deteriorated by local and tourist traffic. In many cases populated areas are served by local roads without all-weather surfacing which may impair emergency vehicle access or escape routes during emergencies. Severe winter conditions can damage and slow traffic on State and County-maintained road systems.

Because of the increased number and intensity of recreational, residential and commercial developments planned for the Mountains, existing roadways will be even more severely burdened in the future. Furthermore, the steep terrain and physical environment of the Mountains make it difficult or impractical to build new roads or widen existing roads.

Unlike urban areas where roads crisscross the land, the majority of the County's Desert region, because of its vast size and scattered pattern of development, has a limited number of access roads. Because of this limited access (no legal right-of-way), many Desert landowners cannot reach their property without trespassing. The problem of approved access has plagued the Desert region for some time. But, by carefully selecting the location of new roads and maintaining a narrow definition of approved access, the County can protect areas of unique scenic, wildlife and vegetative habitats as well as deter premature subdivision of land which could require costly County services.

The quality of public and private roads found in the desert varies immensely. Surfaces range from asphalt and concrete to gravel and dirt. As a consequence, the standards for new roads added to the County system must be high in order to assure that maintenance is low. Here, as in other regions, transportation improvements must be planned and phased together with land use goals and policies.

Looking at the Southern California Region's urbanized and urbanizing areas, today's traffic congestion will progress to gridlock by the year 2010 unless ways are found to avoid it. The highway construction projects already programmed, which include the I-15 extension and the new Route 30 in the Valley area of San Bernardino County, will not avert the gridlock. Only by following a comprehensive strategy, rather than piecemeal responses to crises in a reactionary mode, can the region retain or improve mobility.

Regionally, the greatest increase in vehicular trips will occur in the inland areas, i.e. San Bernardino and Riverside Counties. Population growth will tend to be attracted to the inland area where housing is more affordable. A very high percentage of both the existing population and newcomers will commute every day to Orange and Los Angeles Counties, where the jobs are located. This separation of job location and housing location is a major contribution to both San Bernardino County and regional transportation problems.

The primary focus of this section of the background appendix is toward that portion of the overall circulation system which consists of highways and roads. There are other important elements of the circulation system which will be addressed as subordinate transportation modes. These consist of aviation facilities, transit, rail, bikeways, and pedestrian facilities, all of which will play increasingly important roles in the future in order to relieve the strain on the highway and road network.

A. Agencies With Responsibilities in Transportation and Circulation

Several agencies are directly involved in transportation and circulation in San Bernardino County. These agencies are identified and their functions and responsibilities are defined below:

1. State Level

The State of California Department of Transportation (Caltrans) is responsible for the state highway system, which consists of all freeways in addition to other conventional main highways.

State highways are the main roads connecting the communities and regions of the state. They serve centers of commerce, industry, agriculture, mining and recreation. They carry over half the state's traffic. Each route is described in the Streets and Highway Code. Caltrans recommends and the California Transportation Commission adopts the

exact location of roads to satisfy each route description.

State law requires that a new five-year State Transportation Improvement Program (STIP) be developed every year. The process starts with an update of the previous STIP and with a new five-year revenue estimate. Both Caltrans and regional agencies then select candidate projects for the new STIP and determine priorities. The California Transportation Commission resolves any conflicts.

Within the State of California, Caltrans is divided into a number of districts with regional offices and facilities to serve each district. Almost all of San Bernardino County and western Riverside County are within Caltrans District 8, which has its headquarters in the City of San Bernardino. A small portion of San Bernardino County's northwest corner lies within Caltrans District 9 with headquarters in the City of Bishop in Inyo County. Figures 1 and 2 show Caltrans District 8 and that portion of District 9 within San Bernardino County.

2. Regional Level

The Southern California Association of Governments (SCAG) serves as the areawide planning agency for Southern California and has been designated under state and federal law as the agency for regional transportation planning within its jurisdiction. The SCAG region covers six counties: Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura.

SCAG was formed by local elected officials in 1965 to deal with issues of regional concern. The agency provides a means for working cooperatively towards solutions to problems of interjurisdictional concern and serves as the comprehensive planning agency responsible for orderly growth and development of the region. SCAG develops areawide plans for community and economic development, transportation and utilities, environmental quality and resource conservation, and human services. Funding for SCAG comes from local government dues and from a variety of state and federal grants.

DISTRICT 8 LOCATION MAP

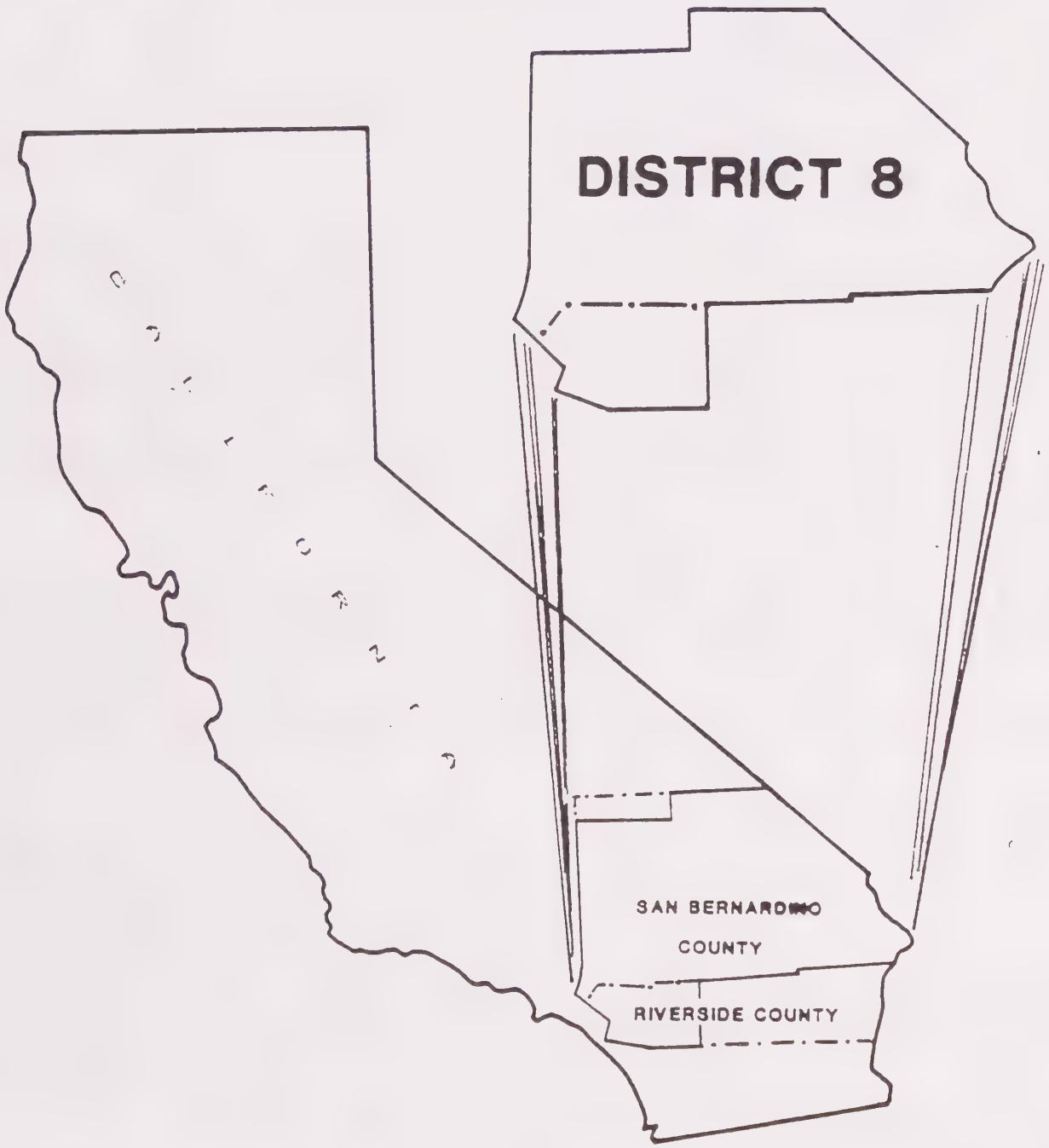


FIGURE 1

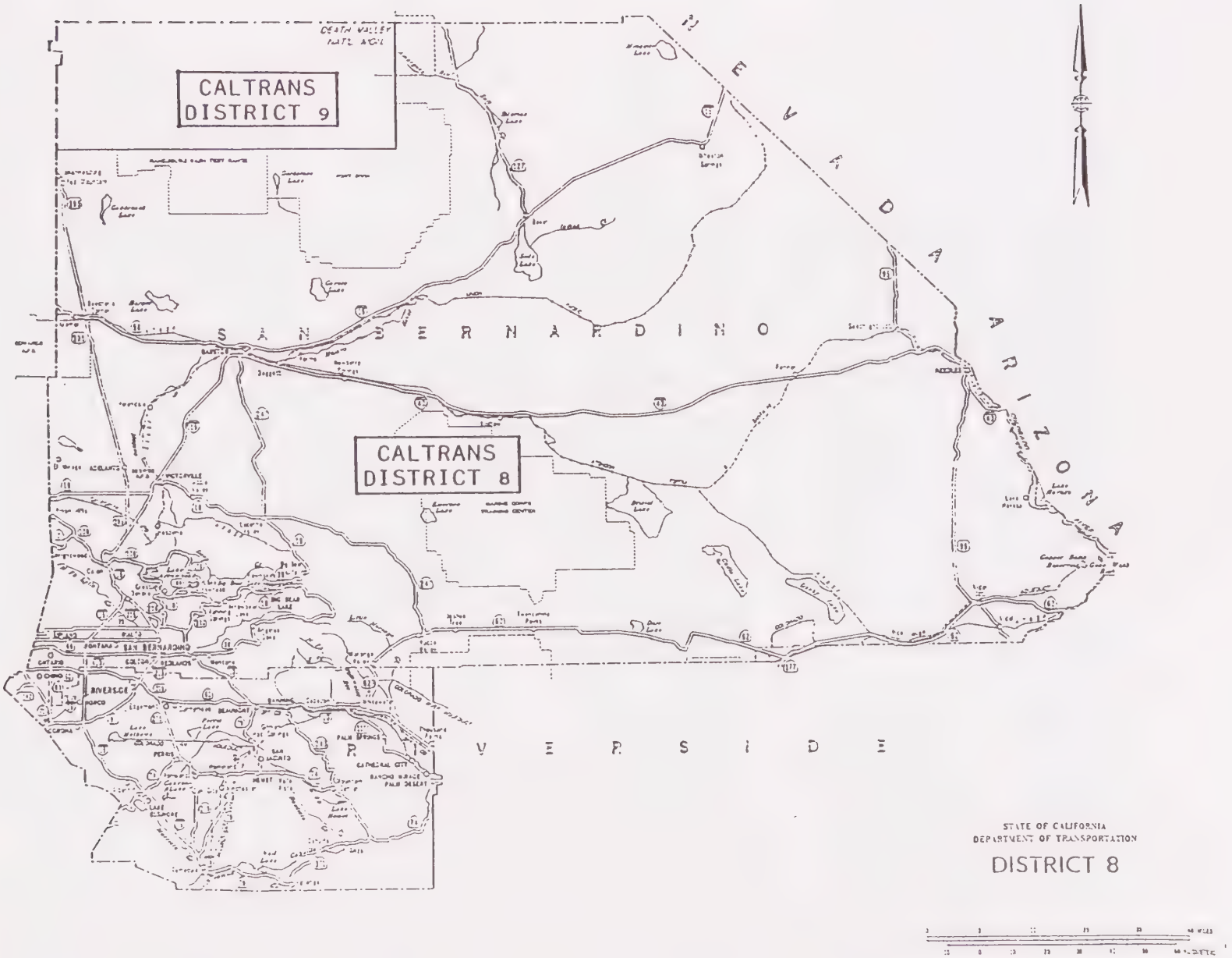

CALTRANS
DISTRICT 9
CALTRANS
DISTRICT 8
NEVADA
ARIZONA
SAN BERNARDINO
RIVERSIDE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DISTRICT 8

FIGURE 2

The roles of SCAG as the regional transportation agency and the county transportation commissions in the transportation planning process are defined in Title 7, Chapter 2.5 of the California Government Code as modified by AB 1246 and AB 402. Federal requirements for preparation of the Regional Transportation Improvement Program (RTIP) are contained in Title 23, Part 450 and Title 49, Part 613 of the Code of Federal Regulations. The new State Transportation Improvement Plan(TIP) requirements are found in Chapter 2.5, Sections 65080-65082 and Chapter 2, Sections 14520-14534 of the Government Code as modified by AB 402.

3. Sub-Regional Level

San Bernardino Associated Governments (SANBAG) was formed in 1973 as a subregional council of governments under a Joint Powers Agreement (JPA). The JPA includes the cities within the county and the County of San Bernardino (Board of Supervisors). The JPA as amended in 1975 outlines the following functions for SANBAG:

- Serve as the forum for consideration, study and recommendation on county-wide, subregional and regional problems.

- Assemble information helpful in the consideration of problems peculiar to the various sections included in the collective area of the association membership.

- Serve as the subregional transportation planning, fiscal programming and coordinating agency.

In 1976, the State, through Assembly Bill (AB) 1246, created County Transportation Commission (CTC's) to coordinate and approve annual Short Range Transit Plans (SRTP's) and Transportation Improvement Programs (TIP's) and to coordinate mass transit service. For San Bernardino County the State designated SANBAG as the CTC. For this purpose, a Governor's representative (historically, the District 8 Caltrans Director) also has a voting seat on the Board.

The most important of these functions is preparation of the annual five year State Transportation Improvement (STIP) for state highways and the

effort in lobbying it through the California Transportation Commission. A second key role is that of allocating several million dollars annually of federal and state highway and transit categorical funds to agencies within the County.

SANBAG exists within the larger six-county Southern California Association of Governments (SCAG) framework and maintains a close relationship with that agency. Planning studies and several financial management programs are jointly performed. SANBAG participates in SCAG's Overall Work Program and receives about 25 percent of its funding from that source.

The basic SANBAG revenue derives from two percent of the county-wide Transportation Development Act (Senate Bill 325) monies, which is a portion (one-fourth of one cent) of the overall six cent sales tax. In addition, there is a modest general fund assessment paid by each city and the County. The budget annually ranges between $300,000 - $500,000 with a significant expenditure going for consultant tasks.

SANBAG's Board consists of one elected member from each city and all five members of the Board of Supervisors. Meetings are normally held on the first Wednesday morning of each month. The staff is purposely kept very small, and in recent years has included an Executive Director plus two Assistant Directors, assisted by two-to-three clerical and technical support personnel.

In 1975, SANBAG conceived OMNITRANS, a sister JPA with much duplicative Board membership, which directs the transit system within the county's valley area. Meetings are held back-to-back, and a close relationship is maintained. Other close working relationships for SANBAG beyond the cities and the county, include Caltrans, SCAG, the California Transportation Commission, the state-wide group of Regional Transportation Planning Agencies, and the sister County Transportation Commissions in the SCAG region. Successful linkages with several key private sector and joint public-private organizations are also in place.

In 1986, SANBAG became the Service Authority for Freeway Emergencies (SAFE) for San Bernardino County. The SAFE is responsible for the implementation and operation of a motorist aid

callbox system on freeways and highways in the county. Funding for the program and its administration comes from a one dollar fee added to annual vehicle registrations collected within the county.

4. Local Level

The Transportation/Flood Control Department of San Bernardino County is responsible for providing safe and driveable public roadways in the unincorporated areas of the county and for providing flood control and related services throughout the county. Local cities are responsible for roadways within their respective incorporated areas.

The Transportation/Flood Control Department's function also includes contracting for and coordination of public transit activities in various parts of the county, including the services provided by OMNITRANS in the unincorporated portions of the San Bernardino Valley and Dial-a-Ride systems in a number of unincorporated communities in the mountain and desert areas of the county.

The primary transportation (road) function of the department is operation, maintenance, and improvement of the county road system which currently includes over 4,250 miles of roadways. Additional major activities are administration, planning design, construction, and traffic operations. Management and technical activities are centered in the San Bernardino area. Maintenance functions are provided through 15 Yard Districts with regional facilities located throughout the county to best serve the vast 20,000 square-mile area of the county.

The county road budget receives about $25 million (from all sources) per year to provide for resurfacing, rehabilitation, construction and routine maintenance activities. Since the funding available for road purposes is very limited compared to the needs of the vast system, all work is prioritized in order to insure optimum use of the available funds. Among the Department's high priorities are to provide for needed maintenance to protect the investment in the existing roads and to provide for improvements to the safety, capacity and serviceability of the roads.

Routine maintenance activities of the Department include patching and crack filling on approximately 7,500 lane-miles of asphalt pavement, grading of 663 miles of unpaved roads, shoulder maintenance, snowplowing of approximately 450 miles of mountain roads, traffic signal maintenance at 73 intersections, roadside weed abatement in urban areas, traffic sign and pavement striping maintenance throughout the system, storm repairs and clean up, maintenance of 380 bridges and thousands of metal pipe and concrete box culverts, and maintenance of drainage facilities such as inlets, ditches, dikes, and gutters.

Resurfacing, rehabilitation, and major improvement projects on the road system include, on an annual average, major asphalt overlays on about 50 miles of roadways, pavement sealing on approximately 260 miles, installation of traffic signals and lighting at three intersections, widening from two-to-four lanes on three miles of roadway and reconstruction of five miles.

Many other road improvements are accomplished through cooperative efforts with other public agencies. Such cooperation provides funding opportunities and economy of construction as well as improved services to the traveling public. Agencies involved in such efforts are cities within the county, special districts, federal, state, regional agencies and utility companies.

New roads to serve developing areas are usually constructed by developers at no cost to the county and then accepted into the county road system for maintenance by the Transportation Department. Several million dollars of such road construction is performed by developers each year.

5. Air and Rail Transport

The San Bernardino County Airports Department operates seven airports throughout the County. The airports under the County's jurisdiction are located at Chino, Barstow, Apple Valley, Twentynine Palms, Needles, Baker, and Trona. In addition, there are many other airports throughout the County which are operated by cities, the U.S. Department of Defense (military airports), or are privately owned and operated.

The City of Los Angeles Department of Airports operates Ontario International Airport (OIA) in the County's Valley region. OIA ranks among the top 100 busiest airports in the world and is one of the fastest growing airports in the U.S.; it is also a major reliever to air traffic at Los Angeles International Airport and is the prime airport for the inland areas of San Bernardino and Riverside Counties.

Rail Service in San Bernardino County is handled entirely by the private sector. Three major transcontinental railroad companies (Santa Fe, Union Pacific, and Southern Pacific) provide freight service. Passenger service is provided by Amtrack.

II. CURRENT STATUS

A. Sources of Data/Analysis

Sources of data and analysis on the topic of transportation and circulation are almost endless, especially for the Southern California metropolitan area which includes the Valley area of San Bernardino County. The agencies with primary responsibility for transportation planning have been described. These agencies (Caltrans, SCAG, SANBAG, San Bernardino County Department of Transportation/Flood Control, San Bernardino County Airports Department, and the City of Los Angeles Department of Airports) are the source of data and analysis in this background appendix.

B. Scope of Existing Conditions/Trends

1. State Highway System

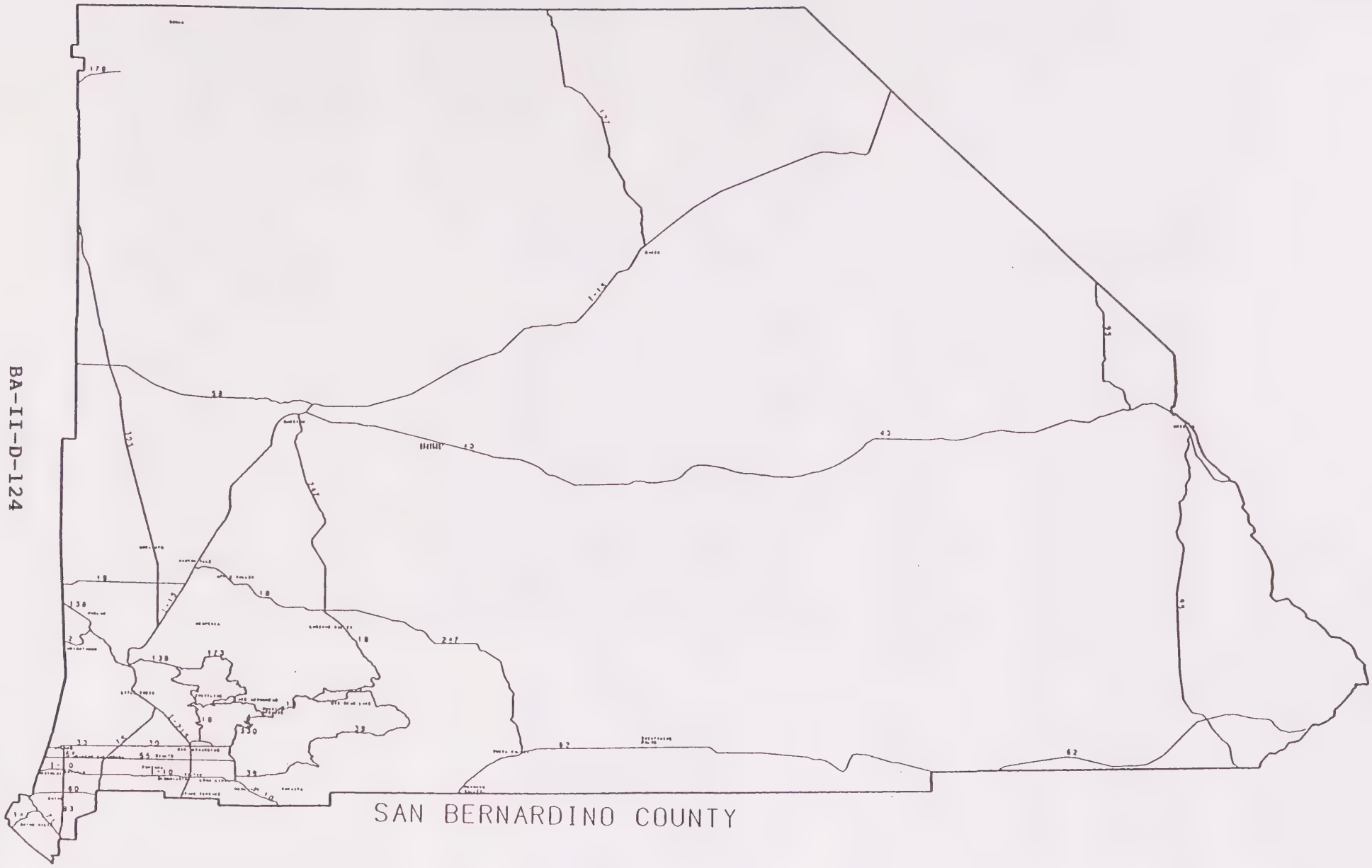
As stated earlier in this report, state highways are the main roads connecting cities and regions of the state. Three different types of route "shields" appear on California's state highways: Interstate, U.S., and California. The Interstate and U.S. systems are national networks of state highways numbered by the American Association of State Highway and Transportation Officials (AASHTO). Most of the Interstate system was built with federal-aid Interstate funds, and much of the U.S. system was built with federal-aid Primary funds. Figure 3 shows the three different types of "shields" of state highways.

Fig. 3 State Highway Shields

Most state highways are constructed and reconstructed using federal-aid, which is divided among four federal-aid systems: Interstate, Primary, Secondary, and Urban. Routes are assigned to federal-aid systems according to federal laws and rules under which roads and streets are ranked according to their function--arterial, collector, or local road.

Almost all state highways are arterials and are in the Primary systems, which includes Interstate highways. The Secondary system, on the other hand, consists of rural collector roads that are almost all county roads. Only a few city streets and state highways are on the Secondary system. And finally, the Urban system consists of urban arterials and collectors. While most of these are city streets, a surprising amount of the mileage is under county jurisdiction and some is in the state highway system.

State highways are of three design types-freeway, expressway, and conventional. Freeways are four-lanes or more and separate the two directions of travel. They have no access to adjacent property, and their crossings go over or under the freeway. Expressways may be two-lane undivided or four-lane divided. They may have crossings at grade level, and they may have either full or partial access to property. More miles are driven on freeways than on the other types of state highways. Figure 4 shows all the existing state highways within San Bernardino County.



BA-II-D-124

FIGURE 4

The principle source of revenue for the highway program is fuel tax. Gasoline is taxed 18 cents per gallon, 9 cents by the federal government and 9 cents by the state. Federal and state laws earmark this tax, alongwith other "road-user" taxes for transportation, mostly highways. Additional state highway revenues come from truck weight taxes and can come from vehicle registration fees and from driver's license fees if such revenue is not required to support the Department of Motor Vehicles.

The 9-cent state gasoline tax is apportioned among the cities, counties and the state by formula so that cities get 2.06 cents, counties 2.33 cents, and the state 4.61 cents. Of the 9-cent federal gasoline tax, 8 cents is earmarked for highway construction and reconstruction, with the remaining one cent for mass transit. Besides gasoline taxes, federal highway revenues come from taxes on special fuels, truck sales and use, truck parts, and taxes. The federal tax on diesel fuel has been increased to 15 cents per gallon, to replace some truck use fees.

Congress appropriates federal funds for each fiscal year to be apportioned by separate formula for each of the federal-aid systems: Interstate, Primary, Secondary, and Urban. With over 10 percent of the nation's population, California has received only 7.7 percent of the nation's federal-aid over the years.

The current State Transportation Improvement Program (STIP) for Caltrans District 8 was adopted by the California Transportation Commission on June 25, 1987. The STIP covers the five year period through mid 1992 and is for state highway projects only. A copy was obtained from Caltrans District 8. A summary of the major projects on the current STIP is as follows:

Highway	Project
I-10	Yucaipa Blvd interchange; reconstruct interchange.
I-15	La Paz/Hook Road, Victorville; construct interchange.

18	Big Bear Lake dam; strengthen dam (Caltrans share) and replace bridge.
18	Big Bear; widen to four lanes from Pine Knot Avenue to Stanfield Cutoff.
30	San Bernardino/Highland; construct4-lane freeway from Arden Avenue to 5th Street, including connection to Route 330 north of Highland Avenue.
30	Highland/Redlands; widen to 4-lane freeway from 5th Street to I-10.
58	East of Kramer Junction; upgrade a 15-mile section to 4 lanes, from 3.6 miles east of Route 395 to 0.6 mile west of Valley View Road.
58	Barstow; realign and connect to I-15 southwest of Barstow.
138	West of Summit Valley; construct 4-lane expressway (partially dependent on federal funding) from 1.2 miles east of I-15 to Summit Valley post office road.
I-215	San Bernardino; widen freeway (subject to CTC resolution G-85-4), from I-10 to Route 66 at various locations.
I-215	San Bernardino; construct I-215/30 interchange (Highland Avenue to H Street).

The total cost for the District 8 five year STIP is $220 million. The STIP is coordinated with and forms a part of the Regional Transportation Improvement Program (RTIP) prepared by SCAG, which will be discussed in the next section of this report.

Caltrans District 8 also has a District System Management Plan, 1986, which is a long range strategic document to identify and recommend system improvements. Their system planning consists of three components: Route Concept Reports (RCR), Route Development Plans (RDP), and the District System Management Plan (DSMP). The

RCR defines the route concept which is a statement of how individual routes should perform during the twenty year planning period. The RDP identifies improvements on individual routes that can be funded under various funding scenarios during the five years after the 1984 State Transportation Improvement Program has been implemented. The DSMP is the final element of the first cycle of the planning process and is intented to:

- Explain the System Planning process
- Present the District Transportation Improvement Strategy
- Guide near-term transportation improvements decisions toward long-term objectives
- Document the first cycle of the System Planning process
- Provide direction for future cycles of System Planning

2. Regional Transportation (SCAG)

The Regional Transportation Improvement Program (RTIP) for the six-county SCAG region is a five-year multimodal program of regional transportation improvements for highways, transit, and aviation. The RTIP is comprised of projects consistent with the long-range element of the Regional Transportation Plan (RTP). The projects are directed at improving the overall efficiency and people-moving capabilities of the existing transportation system while incrementally developing into the long-range plan.

The RTP establishes a broad planning framework for the development of transportation systems throughout the region. The RTIP is a programming device which indicates how financial resources are to be allocated for the next five years. Accordingly, the RTIP is monitored with the intent of assessing the effectiveness of the RTP as a long-range guide to transportation development. Information gathered through the monitoring process is utilized as a major source for recommendations to amend the RTP.

The purpose of the RTIP is to coordinate county and regional level planned expenditures of federal, state, and local dollars on transportation projects. Inclusion in an approved RTIP is a necessary condition for federal approval of transportation projects funded from FAU, FAI, FAP, UMTA Section 9 and UMTA Section 3 funds in urbanized areas. In addition, the County Transportation Commission Act (AB 1246) requires that, in commission counties, all surface transportation projects funded by federal and/or state transportation funds, including TDA funds, be included in the RTIP. AB 402 requires that all funds that flow through the California Transportation Commission must be shown in the RTIP. The only funding source that AB 402 adds to the RTIP in addition to the federal regulations and AB 1246 is the California Aid to Airports Programs (CAAP).

AB 1246 and AB 402 require that the County Transportation Commissions in Los Angeles, Orange, Riverside, and San Bernardino counties develop and approve TIPs for their respective counties and forward them to SCAG. Similarly, the Imperial Valley Association of Governments (IVAG) and Ventura County Association of Governments (VCAG) are responsible for developing and approving the TIPs for their respective Counties.

SCAG, in accordance with AB 402, incorporated the TIPs from the four County Transportation Comissions plus project submissions from Ventura and Imperial Counties into a Regional Transportation Improvement Program (RTIP). At SCAG, the RTIP was reviewed for consistency with the Regional Transportation Plan and with the Air Quality Management Plan (AQMP). Projects were also reviewed by SCAG to ensure that there were no conflicts between county TIPs.

SCAG and the County Transportation Commissions must also consider for approval and incorporation into the RTIP any changes the California Transportation Commission has made in the STIP. The Commission adopted a State TIP and submitted it to the Governor and Legislature in July 1987.

Regional transit projects are also addressed in the RTIP. County transit TIPs are based upon local project sponsor submittals. The County Transportation Commissions, IVAG, and VCAG reviewed the submittals for consistency with transit

operator short-range transit plans, and county programs, and available financial resources. San Bernardino County's transit operators in Adelanto, Barstow, Needles, Victorville, and the Valley region (Omnitrans) are listed and summarized regarding the amount of funding programmed through 1992.

SCAG, per federal regulations, has incorporated the TIPs from the county transportation comissions plus project submissions from Ventura and Imperial Counties into the RTIP. At SCAG the transit portion of the RTIP was review for consistency with the Regional Short-Range Transit Plan, the Regional Transportation Plan and the Air Quality Management Plan (AQMP). Projects were reviewed by SCAG to ensure that there were no conflicts between county TIPs.

Most of the RTIP is taken up by geographic project listings for each of the six counties with the SCAG region. The San Bernardino County project listings are divided into the following categories:

- State highways
- Local highways: listings for each city and county areas.
- Transit: listings for Adelanto, Barstow, Needles, Omnitrans, and Victorville.

3. Sub-Regional Transportation (SANBAG)

At the subregional level, the San Bernardino Association of Governments (SANBAG) acts as both the County Transportation Commission (CTC), and as the subregional transportation planning agency. As the CTC, SANBAG is responsible for the evaluation and approval of all projects utilizing state, federal, and local transportation funds within the County. Other responsibilities include the coordination of transportation planning, operations, and programming of funds. SANBAG prepares the County Transportation Improvement Program (TIP) and determines which programs and projects will be funded through the State Transit Assistance Act (SB 620).

SANBAG provides technical assistance to Omnitrans for capital improvements, special studies, regional service evaluations, and short and long range service planning. A formal letter of agreement between SANBAG and Omnitrans outlines the roles

and responsibilities of each party with respect to regional planning and program funding. Funds totaling more than $80,000 have been made available to Omnitrans during the current fiscal year for specific planning activities. These include funds for system line-by-line analysis, market research, fixed-route schedule analysis, and other short range planning activities.

As the principal provider of public transportation services within the San Bernardino and Yucaipa Valleys, Omnitrans serves thirteen area cities, as well as the unincorporated areas of Bloomington, Los Serranos, Mentone, and Yucaipa in a 480 square mile operating area.

The current Omnitrans Short Range Transit Plan 1987-91 was prepared with assistance from SANBAG. The Plan is a service planning, policy and funding document. As a service planning document, it analyzes current service performance for all Omnitrans services: fixed route bus service, Dial-A-Ride, Dial-A-Lift, and Van Go. As a policy document, it outlines adopted policies regarding service standards, fares, public input, contingency planning, and interagency coordination. As a funding document, the service planning and policy components are coordinated closely with state and federal grant compliance requirements. All projects proposed for funding are outlined in the Transportation Improvement Program (TIP) list of projects in the Plan's appendices. Approval of the TIP and its justification statement (the Short Range Transit Plan) is required before grant applications or claims for any new project can be filed with state or federal funding agencies. A new Short Range Transit Plan for the period 1989-93 will go before the board for approval in July 1988.

SANBAG also prepared the Short Range Transit Plan 1989-93 for San Bernardino County's Mountain and Desert regions. The plan was adopted in April, 1988, and includes the following Mountain and Desert transit operations:

Adelanto Dial-A-Ride
Barstow City Dial-A-Ride
Barstow County Dial-A-Ride
Big Bear Dial-A-Ride
Crestline Dial-A-Ride
Roadrunner Transit Service

Needles Elderly and Handicapped Dial-A-Ride
Victorville Fixed Route
Victor Valley Elderly and Handicapped Dial-A-Ride

The Mountain/Desert plan is divided into four chapters; Adelanto, Barstow, Needles, and Victorville. Each chapter is further divided into four sections. The first section provides an introductory statement about the transit operation, describes the coordination activities with planning and programming agencies, and responses to comments received from the Urban Mass Transit Administration relating to last year's plan. A description of the service provided, fare structure, fleet inventory and maintenance program and operating, financial, and performance characteristics for FY 1983-84 through FY 1985-86 are included in the second section. The third section provides an evaluation of the services and a discussion of needs and deficiencies identified. The description and justification for the planned service level and capital improvements are included in the fourth section.

In addition to the Short Range Transit Plans, SANBAG administers the Service Authority For Freeway Emergencies (SAFE) program is San Bernardino County. The program will provide emergency call boxes on the state freeway and expressway system. SANBAG and the Riverside County Transportation Commission have formed a joint technical advisory committee for the development of a detailed implementation program in the two counties. The authority to establish a SAFE program is from SB 1199 and SB 202. A fee, not to exceed $1 per year, may be imposed as a surcharge on vehicle registration within the respective counties to fund the program. The program is now in phase 1 of a contract to determine the number of call boxes needed and the appropriate locations.

SANBAG, as the county transportation commission, drafted the original proposal for Measure A, the proposed San Bernardino County Transportation Improvement Program which was defeated at the polls in November 1987. The program would have raised nearly $900 million for needed highway, street, and road improvements throughout the county by imposing a one-half cent sales tax for a period of fifteen years. Under this program, it was intended to spend approximately 60 percent of the monies on specific state highway projects and

40 percent on local streets and roads in both city and county unincorporated areas. Measure A failed to achieve the required 50 percent plus 1 majority; the vote was 55 percent against and 45 percent in favor on a turnout of 22 percent of registered voters. Another sales tax proposal is now being considered for 1989, with a "return to source" guarantee for the Desert area to ensure a fair share of improvements, as the opposition to the proposal was strongest in that region (only 29 percent of voters were in favor); the fifteen year period may be extended to twenty years and consideration is being given to a transit element to reduce senior fares along with a rail commuter element with a Los Angeles-San Bernardino service.

4. Local Road System: County Maintained Roads

The San Bernardino County Maintained Road System (CMRS) contains approximately 4,250 centerline miles, of which 3,600 miles are paved. It should be noted that the new cities of Highland, Twentynine Palms, and Hesperia will decrease the centerline miles in the CMRS by approxi-mately 670 miles when those cities begin to maintain their roads. The current mileage of County-maintained roads in the new cities is as follows:

Hesperia:	424.00
Highland:	90.70
Twentynine Palms:	147.35

Maintenance is provided by the Field Operations Division which is divided into four regions and fifteen districts (maintenance yards) as follows:

Valley Region	- District 1	(Chino)
	District 3	(Fontana)
	District 5	(San Bernardino)
Mountain Region	- District 6	(Yucaipa)
	District 7	(Crestline)
	District 8	(Blue Jay)
	District 9	(Big Bear)
West Desert Region	- District 11	(Baldy Mesa)
	District 12	(Barstow)
	District 13	(Trona)
	District 16	(Apple Valley)
East Desert Region	- District 2	(Big River)
	District 10	(Twentynine Palms)
	District 14	(Mt. Pass)
	District 15	(Needles)

(There is no District 4)

Figure 5 shows the above maintenance yard districts and miles of maintained roads.

Funds for maintenance and construction of county roads are derived almost entirely from highway user taxes and fees. The major source is the State Fuel Tax which funds work on the state highways, county roads, and city streets. The 9 cent per gallon State Fuel Tax is allocated as follows: 4.61 cents to the State Highway Account, 2.36 cents to the cities and 2.03 cents to the counties. No property taxes or other general funds are used for maintenance or improvement of roads in the county system. Generally speaking, the county's share of the fuel tax fund is based on the number of registered vehicles. The county road fund receives about $15 annually for each vehicle registered in the county. Since San Bernardino County is very large (over 20,000 square miles) with many sparsely populated and widely separated communities, revenue in terms of dollars per mile is very low compared to the more densely populated counties such as Los Angeles and Orange which receive over 10 times as much State Fuel Tax money per mile of road in their roads systems. The County's transportation budget for fiscal year 87-88, which is almost $25 million, is shown graphically in Figure 6.

Over the years the ability of the county to maintain and improve the Road System has been severely affected by the inflation of costs. Since the Fuel Tax is on a per gallon basis, the amount paid by the average driver has actually declined over the last several years due to more fuel efficient vehicles and the resultant decline in the amount of fuel purchased. Construction of major improvements such as new roads, bridges or the addition of lanes is limited to a few projects per year and can only be undertaken when federal aid for highways or other special grant funds are available.

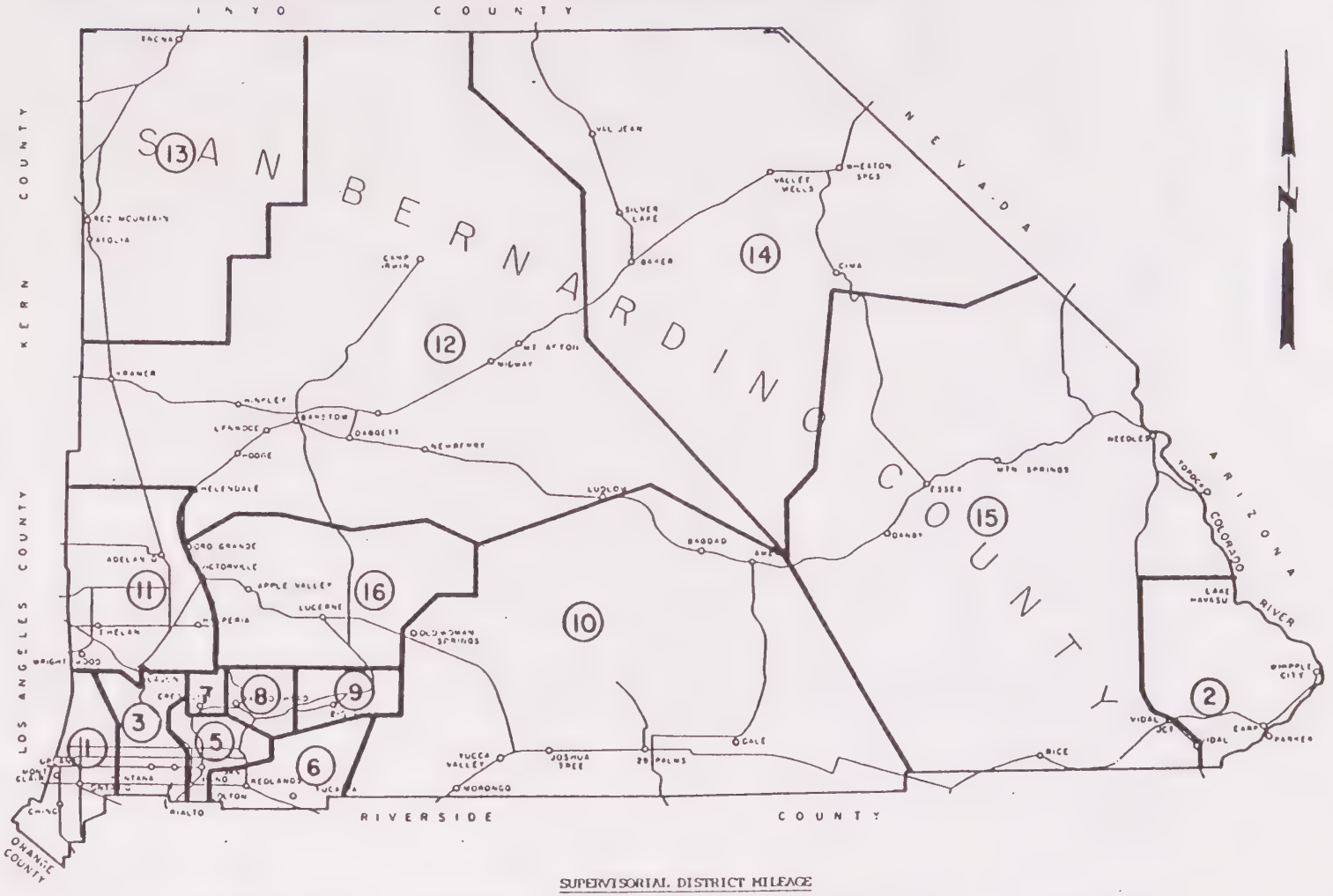
According to state law, neither road fund revenues nor County General Funds may be expended on roads which have not been accepted into the County Maintained Road System by the Board of Supervisors with the concurrence of the state.

Of the 4,250 miles of road in the San Bernardino County Maintained System almost 700 miles are still unpaved. Practically all of these unpaved

SAN BERNARDINO COUNTY TRANSPORTATION DEPARTMENT

MAINTENANCE YARD DISTRICTS
AND MILES OF MAINTAINED ROADS
AS OF MAY 1, 1987

YD	DISTRICT	MILES
1	CHINO	180.72
2	BIG RIVER	90.41
3	FONTANA	218.74
5	SAN BERNARDINO	208.07
6	YUCAIPA	259.00
7	CRESTLINE	81.04
8	BLUE JAY	148.72
9	BIG BEAR	85.26
10	TWENTYNINE PALMS	592.61
11	BALDY MESA	732.85
12	BARSTOW	562.27
13	TRONA	55.51
14	IVANPAH	191.07
15	NEEDLES	218.91
16	APPLE VALLEY	637.58
TOTAL		4,262.76



SUPERVISORIAL DISTRICT MILEAGE

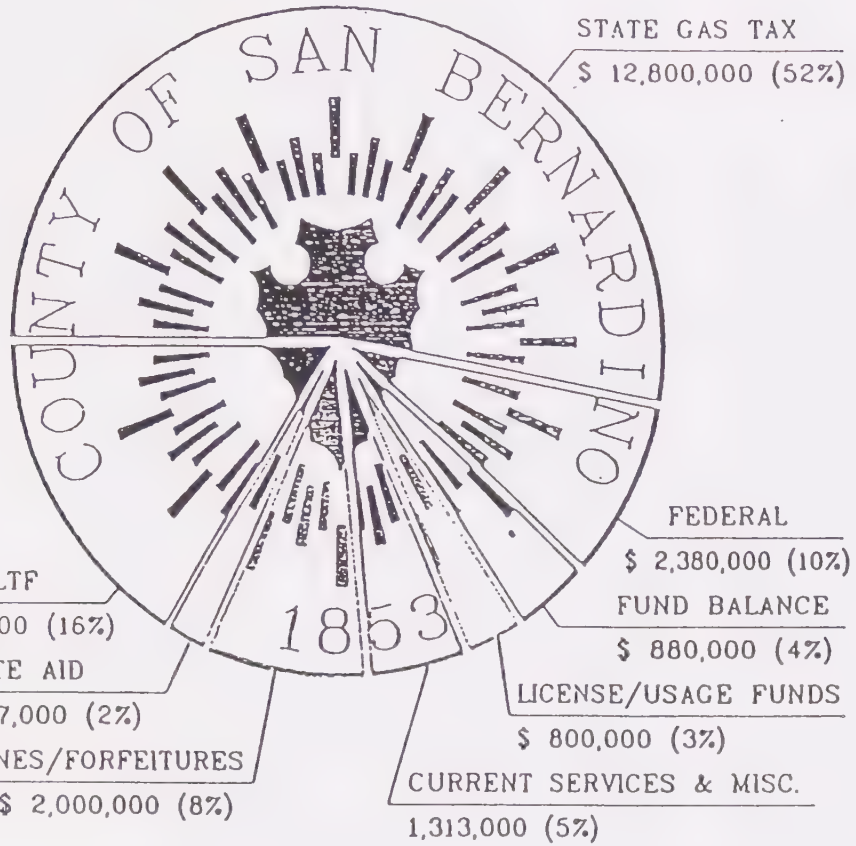
SUPERVISORIAL DIST. 1	SUPERVISORIAL DIST. 2	SUPERVISORIAL DIST. 3	SUPERVISORIAL DIST. 4	SUPERVISORIAL DIST. 5
3,278.30 Mi.	308.52 Mi.	394.50 Mi.	164.20 Mi.	135.24 Mi.

FIGURE 5

S.B.C.F.C.D. PLANN[illegible] BM-DIO-6

TRANSPORTATION BUDGET F.Y. 87-88

REVENUES
$ 24,600,000



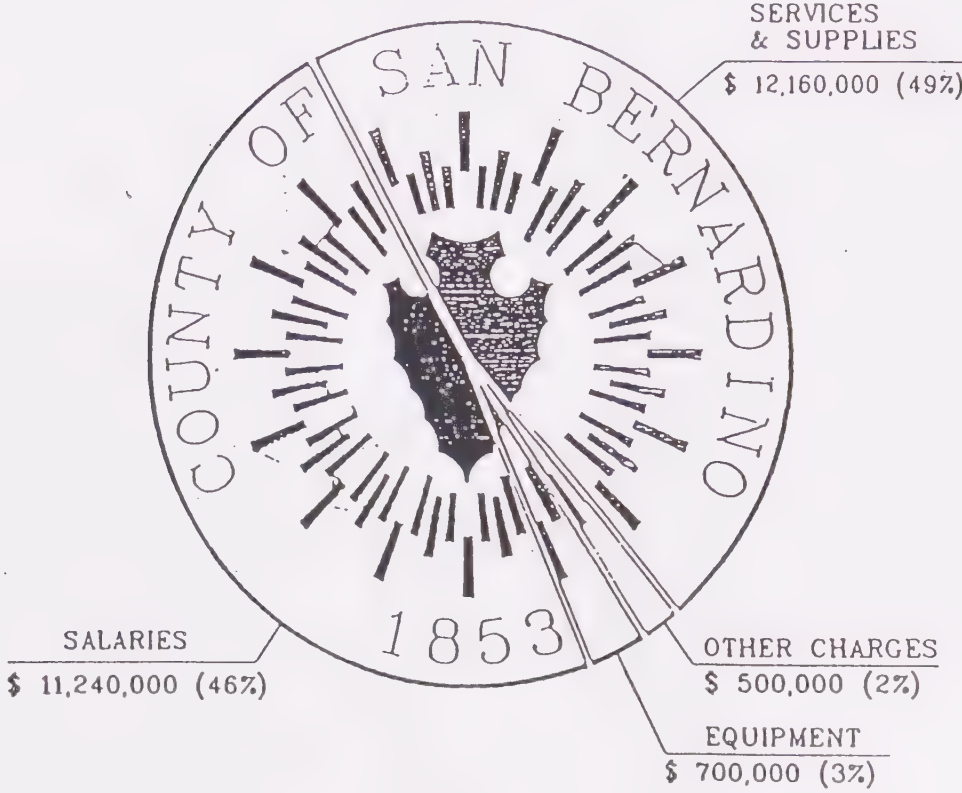
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Summary of Changes From F.Y. 86-87 Budget

STATE GAS TAX	+ $ 500,000
STATE AID	- $ 480,000
LTF SB325	- $ 720,000
SB 300	- $ 1,930,000
FEDERAL AID	- $ 371,000
CURRENT SERVICES (Rood Fees & Misc.)	+ $ 264,000
FUND BALANCE	- $ 3,363,000
TOTAL CHANGE	- $ 6,100,000

TRANSPORTATION BUDGET F.Y. 87-88

APPROPRIATIONS
$ 24,600,000



Summary of Changes From F.Y. 86-87 Budget

SALARIES (3% Increase)	+ $ 320,000
SERVICES & SUPPLIES	- $ 535,000
CONSTRUCTION CONTRACTS	- $ 4,441,000
R/W ACQUISITION	- $ 154,000
STRUCTURES/IMPROVEMENTS	- $ 528,000
EQUIPMENT	- $ 762,000
TOTAL CHANGE	- $ 6,100,000

FIGURE 6

roads have been in the county system since it was formally designated in the late 1940's. Although many of these unpaved roads carry considerable public traffic and provide access to homes and other developed properties, there have never been enough funds improvements to bring these roads up to current county road standards.

There are many additional miles of road in the county which are being used by the general public which are not in the maintained system. As stated above, the county may not perform any work on these roads.

The Board of Supervisors receives many requests annually to accept additional roads into the maintained system. Due to the funding limitations described above and the difficult task of taking care of the roads currently in the system, it is impossible to honor all these requests. Therefore, in 1964 the Board of Supervisors adopted a policy outlining the criteria for road acceptance into the maintained system. In general, the criteria requires that prior to acceptance there be appropriate right-of-way dedications and construction of road improvements, including pavement, to county standards at no cost to the county. The specific construction requirements vary considerably depending on the location and the classification of the road involved.

In a few rare exceptions to this policy, the Board has accepted roads without requiring improvements. Such exceptions have, however, been limited to roads determined by the Board of Supervisors to be necessary in the general county interest, such as roads connecting communities or where a road was needed to serve a major public facility.

In response to the increasing road funding concerns, the Board of Supervisors adopted a further policy (in 1981) to specifically provide that roads may be deleted from or rejected for acceptance into the county maintained system for the following reasons:

a) The county highway does not provide the primary access to occupied properties as determined by inspection of all available access routes, or

b) Traffic on the county highway isintermittent and of low volume as determined by counting the Average Daily Traffic (ADT). The minimum ADT is established as 75 vehicles per day.

Prior to the termination of maintenance of a county highway, public hearings are conducted to receive testimony regarding the proposed deletion from the county system. This is done in order to provide an opportunity for all interested parties to provide comments on the proposed action.

Since the costs to fulfill the requirements of the county policy for acceptance of roads into the county maintained system are usually very high, the most common solution to maintenance problems on non-system roads is for the property owners involved to perform any needed maintenance or to hire a private contractor to do grading and other maintenance work or to make any improvements desired by the users. In many areas, special districts have been formed to provide for maintenance of roads that are not in the county system. A special road assessment is paid by the owners of property in such areas. This program is administered by the county's Special Districts Department.

5. County/City Road Standards

A review of the county and cities' General Plan Circulation Elements reveals an inconsistent and confusing situation as regards designation of roads, right-of-way (R.O.W) distance, and curb-to-curb separation distances. This is not to say that the county's road standards are correct and the cities' incorrect, but to indicate an inconsistency that needs to be brought to the attention of all those involved in transportation/circulation throughout the county.

A recent meeting of the City/County Planning Directors on this topic produced agreement that there is a need to search for common road standards. A suggestion was made to schedule a meeting for all city and county planning directors and roads/public works directors to discuss the possibility of making road standards uniform for all jurisdictions.

Figures 7, 8 and 9 on the following pages show the current General Plan Circulation Element road designations and standards for each city and for county unincorporated areas for the East Valley, West Valley, Desert, and Mountain regions.

6. Air Transport

a. Ontario International Airport

The City of Los Angeles Department of Airports operates Ontario International Airport, located in the City of Ontario between the I-10 and 60 freeways. It is currently served by 14 airlines providing 183 flights a day to destinations that include every major city in America. Airlines such as TWA, American, Delta and United provide daily non-stop service to every airline hub in the country. Further, commuter airlines provide service to large and small cities throughout California.

Since completion in 1981 of the airport's new 10,200 foot runway, passenger traffic has increased to over three million persons a year. Air freight operations have expanded to 147,000 tons annually due in part to the large UPS operation which has located at the airport.

Ontario is the only Southern California civilian airport other than Los Angeles International capable of handling all wide-body jets. As LAX has just about reached its passenger and cargo handling capacities. Ontario Airport's operations are slated to continue to expand at an accelerating rate. In 1987, 4.5 million passengers passed through the Airport's terminal building. According to the Airport's 1987 Information bulletin, the facility is expected to experience close to a fourfold increase in passenger use by 1995 - from 3.1 million annual passengers in 1984 to 12.0 million by 1995.

EAST VALLEY CIRCULATION ELEMENT DISIGNATIONS AND STANDARDS

JURISDICTION	ROAD DESIGNATIONS AND STANDARDS R.O.W.'s/Curb to Curb Separation			
County	Freeway	Divided Major: 120'/94' (includes 18' divider) Major Arterial: 120'/104'	Major: 104'/80'	Secondary: 88'/64'
Colton	Freeway	- - - - - - - -	Major: 96'/72'	Secondary: 88'/64'
Grand Terrace	Freeway	Divided Major: 120'/94'	Major: 100'/72'	Secondary: 88'/64'
Loma Linda	- - - -	Scenic Highway: 120'/76'	Major: 100'/72'	Secondary: 88'/64'
Redlands	Freeway	Major: 120'-80'/72' ..variable special major: variable/variable	Major: 120'-80'/72' ..variable special major: variable/variable	Secondary: 88'-80'/64' ..variable
Rialto	Freeway	Divided Highway: 120'/94'	Major Arterial: 110'-100'/96'-72'	Secondary Arterial: 88'/64'
San Bernardino	Freeway	Major Divided: 100'/82'	Major: 100'/80'-72'	Secondary: 88'-80'/60'-66'

FIGURE 7

WEST VALLEY CIRCULATION ELEMENT DESIGNATIONS AND STANDARDS

JURISDICTION	ROAD DESIGNATIONS AND STANDARDS R.O.W.'s/Curb to Curb Separation			
County	Freeway	Divided Major: 120'/94' (includes 18' divider) Major Arterial: 120'/104'	Major: 104'/80'	Secondary: 88'/64'
Chino	Freeway and Expressway	Urban Primary Arterial: 132'-100'/86'-72'	Rural Primary Arterial 100'/52'	Urban Secondary Arterial: 88'/64' Rural Secondary Arterial: 88'/52'
Fontana	Freeway	Divided Major: 120'/76'	Major: 100'/72'	Secondary: 88'/64'
Montclair	Freeway	Arterial: 125'-90'/variable	Major: ≥100'/variable	Secondary: 100'-88'/variable
Ontario	Freeway	Divided Arterial: 120'/80'	Standard Arterial: 100'/76'	Collector Street: 88'/64'
Rancho Cucamonga	Freeway	Major Divided Arterial: 120'/94'	Major Arterial: 100'/76'	Secondary Arterial: 88'-74'/64'
Upland	Freeway	Major Arterial: 214'-100'/160'-72'	Minor Arterial: 132'-66'/74'-40'	

DESERT CIRCULATION ELEMENT DESIGNATIONS AND STANDARDS

JURISDICTION	ROAD DESIGNATIONS AND STANDARDS			
		R.O.W.'s/Curb to Curb Separation		
County	Freeway	Divided Major: 120'/94' (includes 18' divider) Major Arterial: 120'/104'	Major: 104'/80'	Secondary: 88'/64'
Adelanto	Freeway and Expressway	- - - - - - - - - - - -	Major: 100'/80'	Secondary: 60'/36'
Barstow	Freeway	- - - - - - - - - - - -	Arterial: 125'-60'/84'-40'	Collector: 100'-50'/84'-40'
Needles	Freeway	- - - - - - - - - - - -	Major: 100'/72'	Secondary: 88'-80'/64'
Victorville	Freeway	Parkway: 100'/80'	Major Arterial: 100'/80'	Secondary Arterial: 84'/64'

MOUNTAIN CIRCULATION ELEMENT DESIGNATIONS AND STANDARDS

JURISDICTION	ROAD DESIGNATIONS AND STANDARDS			
		R.O.W.'s/Curb to Curb Separation		
County	- - - -	Mountain Expressway 104'	Mountain Major: 80'/64'	Mountain Secondary: 60'/44'
Big Bear Lake	- - - -	- - - - - - - - - - - -	Primary Arterial: 80'/64'	Secondary Arterial: 60'/44'

FIGURE 9

b. San Bernardino County Airports

The County's Airports Department operates the following seven airports:

- Apple Valley Airport
- Baker Airport
- Barstow-Daggett Airport
- Chino Airport
- Needles Airport
- Trona Airport
- Twentynine Palms Airport

In response to a request for information regarding the county operated airports, the Airports Department stated that Barstow-Daggett Airport and Twentynine Palms Airport have a potential for commuter air service for the High Desert area. Both of these airports are attended, are lighted, and have instrument approaches. Both of these airports are adjacent to large military facilities and to key population centers.

Apple Valley Airport, to a lesser degree, has a potential for air service, however, it does not have an instrument approach. It does have facilities to accommodate community air service. Apple Valley is also at present being reviewed for joint venture development for commercial and heavy aircraft activity.

The following is a summary of each county operated airport:

1) Apple Valley Airport

- Location and size of airport:

  21600 Corwin Road, Apple Valley, CA 92307 Thomas Bros. Coordinates: 317 F6.Located approximately seven miles northeast of the city of Victorville and five miles east of Interstate 15, 420 acres.

- Type of service provided:

  General aviation.

- Air Traffic:

  Approximately 42,000 operations annually.

- Number of passengers/amount of freight:

  Unavailable.

- Number of aircraft based at airport:

  130 aircraft and 5 helicopters.

- Expansion plans and/or master plans for airport:

Preapplications to the Federal Aviation Administration have been approved by the Board and filed to conduct (a) a master plan study and environmental impact report, and (b) to acquire additional land to construct a crosswind runway.

The airport has participated in a water main extension with Apple Valley Ranchos Water Company and is presently in the final planning stage to provide a further main extension onsite at the airport for fire protection and potable water service.

There is also pending a proposal to acquire or to enter into a joint venture agreement with the County to expand and operate Apple Valley Airport.

Based on recent experience, if adequate services can be provided by private enterprise, Apple Valley Airport will continue to grow at a substantial rate. Please refer to the aviation forecast for SCAG by CH2M Hill/-Rawlings Enterprise for forecast based aircraft and air traffic activities.

2) Baker Airport

- Location and size of airport:

  Thomas Bros. Coordinates: 706 E6. Located approximately two miles north of the city of Baker, 240 acres.

- Type of service provided:

  Emergency airfield.

- Air traffic:

  Unknown.

- Number of passengers/amount of freight:

  Unknown.

- Number of aircraft based at airport:

  0

- Expansion plans and/or master plans for airport:

Baker Airport is basically an emergency airfield lighted but unattended. A master plan for this airport is projected for 1991. Based on budgetary considerations, a larger runway may be constructed and the airport fenced prior to that time.

Extensive commercial or mining development could change the character of this airport within the next three years. Conversely increased environmental restrictions may reduce the significance of this airport.

3) Barstow-Daggett Airport

- Location and size of airport:

  Star Route Box 3, Daggett, CA 92327 Thomas Bros. Coordinates: 49A B3 Located approximately six miles east of Daggett and

12 miles east of Barstow, 1087 acres.

- o Type of service provided:

  General aviation.

- o Air traffic:

  Approximately 25,000 operations annually.

- o Number of passengers/amount of freight:

  Unavailable.

- o Number of aircraft based at airport:

  52 aircraft, 3 ultralites, 2 CHP aircraft, 1 CHP helicopter, in addition to about 12 Army helicopters and occasional fixed-wing activity.

- o Expansion plans and/or master plans for airport:

  A master plan for Barstow-Daggett Airport is programmed for federal fiscal year 1989, which may upgrade the airport to a basic transport category from general aviation. There is a great deal of potential for developing airport related activities on the excess acreage on the airport.

  The airport presently experiences a significant level of activity by military aircraft in addition to the based Army aviation unit. This includes C-141 and C-130 activity out of Norton, A10 and 0B10 activity operations by both the Army and the U.S. Marines using Daggett Airport as an interim air operations base.

There has been significant discussion over the past five years regarding extension and strengthening of the main runway, taxiways, and aprons to provide more direct air access to the training center at Fort Irwin. There is a potential execution of this between now and 1992. This would require additional land acquisition to the east of existing Runway 8/26, lengthening and strengthening that runway to accommodate wide body aircraft.

The Army aviation unit is projected to move from Daggett Airport to a new facility at Bicycle Lake on Fort Irwin in early 1992.

Please refer to the SCAG CH2M Hill/Rawlings report for additional aviation activity forecasts.

4) Chino Airport

- Location and size of airport:

  7000 Merrill Avenue, Chino, CA 91710 Thomas Bros. Coordinates: 34 C6 Located approximately four miles southeast of the city of Chino and seven miles south of the city of Ontario, 950 acres.

- Type of service provided:

  General aviation.

- Air traffic:

  Approximately 200,000 operations annually.

- Number of passengers/amount of freight: Unavailable.

- Number of aircraft based at airport:

  949

- Expansion plans and/or master plans for airport:

  A master plan update is presently in process for Chino Airport, including an environmental impact report and anticipated certification of the EIR by the Board of Supervisors in mid-1988.

  The Airports Department anticipated land acquisition under the master plan recommendations on the south side of the airport from Euclid to Grove, north of Kimball and certain acquisition for clear zone between Walker and Baker, south of Remington. We also anticipated construction of a 7000 foot runway south of and parallel to existing Runway 8/26. We anticipated that the area between the existing Lockheed lease on Kimball Avenue, roughly at the former Comet Avenue, to expand westward across Grove along Kimball.

  We call your attention to a proposal for the city of Chino to annex a portion of Chino Airport easterly to Grove Avenue and possibly to include the property acquired from Mr. Eilers at some future date. We anticipate rapid growth at the Chino Airport for both

aviation activities and commercial light industrial activities.

5) Needles Airport

- o Location and size of airport:

  Thomas Bros. Coordinates: 728 B6. Located approximately seven miles south/southwest of the city of Needles, 796 acres.

- o Type of service provided:

  General aviation.

- o Air Traffic:

  Approximately 12,000 operations annually.

- o Number of passengers/amount of freight:

  Unavailable.

- o Number of aircraft based at airport:

  20.

- o Expansion plans and/or master plans for airport:

  A master plan study for Needles Airport is proposed for federal fiscal year 1990 to determine the future role and activity level at Needles Airport. Based on current information, a high level of activity during the interim period is not anticipated.

  Of interest is the fact that a few aircraft owners are relocating their aircraft out of Bullhead City/Laughlin area into Needles to reduce their liability exposure from theft and vandalism.

It is possible that a final site selection and construction of a primary airport to serve the Laughlin area may impact Needles Airport in terms of airspace and reflect in a slight increase of activity at Needles.

Please refer to the SCAG CH2M Hill/Rawlings forecasts.

6) Trona Airport.

- o Location and size of airport.

  Located approximately five miles north of Trona, 150 acres.

- o Type of service provided:

  General Aviation.

- o Air traffic:

  Approximately 100 operations annually.

- o Number of passengers/amount of freight:

  Unavailable.

- o Number of aircraft base at airport:

  3 aircraft.

- o Expansion plans and/or master plans for the airport:

  Trona Airport is under the jurisdiction of the Searles Valley Community Service District. The airport itself is located in Inyo County. The primary role of the Airports Department with Trona Airport is to serve as a pass through agency for the annual $5000 subvention from the state aeronautics fund.

It is proposed in the futu to clarify the Searles Valle Community Service District' legal standing with th California Division o Aeronautics so that Searle Valley can receive direct th annual subvention from th state and control and operate the airport without an intervention by the County Department of Airports. Review with Searles Valley of any future plans for Trona Airport is recommended.

7) Twentynine Palms Airport

- o Location and size of airport:

  Thomas Bros. Coordinates: 150A A6. Located approximately six miles east of the city of Twentynine Palms, 480 acres.

- o Type of service provided:

  General Aviation:

- o Air traffic:

  Approximately 15,800 operations annually.

- o Number of passengers/amount of freight:

  Unavailable.

- o Number of aircraft based at airport.

  23 aircraft, 5 gliders.

- o Expansion plans and/or master plans for airport:

  A master plan study, environmental impact report for Twentynine Palms Airport is proposed for federal fisca year 1989. Some growth has

been experienced at Twentynine Palms recently. This is reflected in the present tiedowns being absorbed and at least one proposal to construct hangars and tiedowns by a prospective lessee.

The Airport is in a favored position to support the Marine Corps facility at Twentynine Palms and increased growth in the Yucca Valley/Twentynine Palms area. The Airport also has the advantage of full facilities and runway length.

Please refer to the SCAG CH2M Hill/Rawlings forecasts.

The Southern California Association of Governments General Aviation System Study, Phase 2, December 1987, prepared by consultants CH2M Hill/Rawlings, provides both based aircraft and operation forecasts for, among others, the San Bernardino County airport system and other general aviation airports in San Bernardino County.

Other Airports

The following is a list of all airport facilities operating under State permit within San Bernardino County which were not previously identified. The location is identifiable only by the Latitude and Longitude.

Public Use Airports

1) El Mirage Sky Ranch Airport
   Private Ownership
   Latitude: 34 37 30
   Longitude: 117 36 15
   Nearest City - Adelanto

2) Sun Hill Ranch Airport
   Private Ownership
   Latitude: 34 45 29
   Longitude: 117 29 45
   Nearest City - Adelanto

3) Big Bear City Airport
Public Ownership
Latitude: 34 15 49 Big Bear City
Longitude: 116 51 13 Airport District
Nearest Community - Big Bear City

4) Hesperia Air Lodge Airport
Private Ownership
Latitude: 34 22 38
Longitude: 117 18 54
Nearest Community - Hesperia

5) Hi Desert Airport
Private Ownership
Latitude: 34 09 15
Longitude: 116 15 05
Nearest Community - Joshua Tree

6) Redlands Municipal Airport
Public Ownership
Latitude: 34 05 00 City of Redlands
Longitude: 117 09 00
Nearest City - Redlands

7) Rialto Municipal Airport
Public Ownership
Latitude: 34 07 41 City of Rialto
Longitude: 117 24 09
Nearest City - Rialto

8) Cable Airport
Private Ownership
Latitude: 34 06 43
Longitude: 117 41 12
Nearest City - Upland

9) Yucca Valley Airport
Private Ownership
Latitude: 34 08 07
Longitude: 116 24 01
Nearest Community - Yucca Valley

Private Use Airports

1) Norton Air Force Base
Public Ownership
Nearest City -San Bernardino
U.S. Department of Defense

2) George Air Force Base
Public Ownership
Nearest City - Adelanto
U.S. Department of Defense

3) Shehorn Ranch
Latitude: 34 25 00
Longitude: 116 36 35
Nearest Community - Yucca Valley

4) Harvard
Latitude: 34 58 00
Longitude: 116 40 00
Nearest Community - Yermo

5) Vidal Junction
Latitude: 34 11 20
Longitude: 114 34 15
Nearest Community - Vidal Junction

6) MAF Airpark (Mission Aviation Fellowship)
Latitude: 34 12 22
Longitude: 115 59 49
Nearest Community - Twentynine Palms

7) Crosswinds
Latitude: 34 09 50
Longitude: 115 59 45
Nearest Community - Twentynine Palms

8) Cones Field
Latitude: 34 09 46
Longitude: 116 02 50
Nearest Community - Twentynine Palms

9) Williamson
Latitude: 34 27 57
Longitude: 117 33 24
Nearest Community - Phelan

10) Gene Wash Reservoir
Latitude: 34 18 29
Longitude: 114 11 09
Nearest Community - Parker

11) Camino
Latitude: 34 50 17
Longitude: 114 57 35
Nearest City - Needles

12) Aberham Ranch
Latitude: 34 24 20
Longitude: 116 37 40
Nearest Community - Lucerne Valley

13) Soggy Dry Lake
Latitude: 34 27 17
Longitude: 116 41 27
Nearest Community - Lucerne Valley

14) Kelly Ranch Airport
Latitude: 34 25 15
Longitude: 116 36 55
Nearest Community - Lucerne Valley

15) DePue (Lenwood)
Latitude: 34 51 10
Longitude: 117 08 05
Nearest Community - Lenwood

16) Four Corners
Latitude: 35 00 00
Longitude: 111 33 45
Nearest Community - Kramer Junction

17) Hart Mine
Latitude: 35 17 00
Longitude: 115 11 50
Nearest Community - Ivanpah

18) Palisades Ranch Airport
Latitude: 34 42 44
Longitude: 117 21 00
Nearest Community - Helendale

19) Helendale
Latitude: 34 49 45
Longitude: 117 18 15
Nearest Community - Helendale

20) Essex Military
Latitude: 34 46 20
Longitude: 115 13 00
Nearest Community - Essex

21) Cussions
Latitude: 34 46 00
Longitude: 115 13 30
Nearest Community - Essex

22) Iron Mountain
Latitude: 34 08 03

Longitude: 115 07 06
Nearest Community - Desert Center

23) Boron Airstrip
Latitude: 35 00 13
Longitude: 117 36 32
Nearest Community - Boron

24) Roy's
Latitude: 34 33 45
Longitude: 125 45 00
Nearest Community - Amboy

25) Luft Hafen
Latitude: 34 38 56
Longitude: 115 45 00
Nearest City - Adelanto

26) Sutton Ranch
Latitude: 34 33 15
Longitude: 117 36 18
Nearest City - Adelanto

27) Adelanto
Latitude: 34 32 30
Longitude: 117 28 00
Nearest City - Adelanto

28) Hansen
Latitude: 34 38 30
Longitude: 117 39 15
Nearest City - Adelanto

29) Krey Field
Latitude: 34 33 48
Longitude: 117 33 10
Nearest City - Adelanto

7. Rail Transport

San Bernardino County is served by three major transcontinental railroads: Santa Fe, Union Pacific and Southern Pacific. In addition passenger service is provided by AMTRAK, however, there is no commuter rail service. In a normal 24 hour period the three railroads move approximately 175,890 tons of freight through the county on their 1,080 miles of track.

Amtrak stations are located in San Bernardino, Barstow and Needles with two eastbound and two westbound trains daily, i.e. the Southwest Chief

and the Desert Wind which provide transcontinental service between Los Angeles and the east coast. A new Amtrak station is proposed in Victorville. The feasibility of commuter rail on existing railroad right-of-ways is being studied by SCAG. This transportation mode will become increasingly important in solving Southern California's mobility problems in the future.

In the San Bernardino Valley, access to each of these railroad lines is readily available as their tracks lie within approximately one mile of one another for over thirty miles.

All three railroads serve the county with modern classification systems, with the Southern Pacific computerized yard in Colton regarded as the most technologically advanced rail terminal in the world. In addition to the Colton facility, the train yard in Barstow is also among the largest class yards in the nation. Santa Fe maintains extensive service facilities and freight classification yards in the city of San Bernardino. Piggyback pickup and delivery service and freight consolidation service are provided by each railroad.

There is a current proposal for a high speed rail line to be built between Ontario and Las Vegas, known as the "Mag-Lev". At this time a bill is in the state legislature to set up a California-Nevada commission to assess the feasibility of the proposed 270 mile-per-hour train. Nevada has appointed eight commissioners to the sixteen member panel. Under the bill, there will be representatives from San Bernardino, Riverside, Orange and Los Angeles Counties, and four at-large members from the State of California.

8. Public Transit

Public transit is provided by a number of operators and systems throughout the County. At present there are no bus lanes or busways for bus transit in the County. In the Valley region Omnitrans is the principle provider of public transportation services and serves thirteen cities and the unincorporated areas of Bloomington, Chino Hills, Mentone, and Yucaipa. Omnitrans provides fixed route bus services, dial-a-ride service (similar to taxi service), and dial-a-lift service with specially equipped vans for the handicapped. The

Mountain and Desert regions are served by the following transit systems:

Adelanto Dial-A-Ride
Barstow City Dial-A-Ride
Barstow County Dail-A-Ride
Big Bear Dial-A-Ride
Big Bear Elderly and Handicapped Dial-A-Ride
Crestline/Lake Arrowhead Transit Service
Desert Area Rapid Transit
Roadrunner Transit Service
Needles Elderly and Handicapped Dial-A-Ride
Victorville Fixed Route
Victor Valley Elderly and Handicapped Dial-A-Ride

9. Private Sector Bus Services

Regional and interstate bus services are provided by Greyhound-Trailways, a private sector company, with terminals in the cities of San Bernardino, Victorville, Barstow, and Needles.

Another private bus company, Desert Stage Lines, operates sub-regional services from a terminal at Twentynine Palms with 3 buses daily to and from Palm Springs, making stops at Joshua Tree, Yucca Valley, Morongo Valley, and Desert Hot Springs.

10. Truck Transport

Many truck cargo carriers entering or leaving Southern California pass through San Bernardino County. Interstate Highways 10, 15, 40 all traverse the County. Because of this highway transportation network the County has become a center for interstate trucking firms.

There are currently ten major truck terminals for freight consolidation and transfer located in San Bernardino County. PIE Nationwide, Yellow Freight Lines, Transcon Trucking, Systems 99, Consolidated Freight, Eagle R.B., International Transport, Roadway, Pacific Truck, and Wells Cargo represent some of the major carriers. Additionally, there are over 80 contract and independent trucking firms which also handle containers.

The County's first and only designated truck route was recently established (December 1988) by the Board of Supervisors. State Route 71 within the Chino Hills Specific Plan area has been designated

and official truck route through an amendment to the Specific Plan.

11. Bicycle Facilities

Bicycle transportation is emerging as an increasingly important mode of travel, for both transportation and recreation purposes. At present there are 70 miles of bikeways in the County. Most of this is accounted for by the 51-mile bikeway along the California Aqueduct from the Los Angeles County line to Lake Silverwood. The development of a County bikeway plan is being actively pursued. Class I bikeways in the County are listed below.

EXISTING BIKEWAYS

Searles Vly (Argus/Trona)[1] MHP/Marshall St	4.00 mi
Glen Mead (Chino Hills)[2] Rolling Ridge/Pipe Line	0.30 mi
Big Bear North Shore (USFS)[3] Standfield CO W 0.97	0.50 mi
West Cucamonga Channel[4] Philadelphia St/Mission Blvd	1.30 mi
California Aqueduct Bikeway[5] County Line/Silverwood Lake	51.00 mi
Navajo Road BVCO/Yucca Loma Rd	2.00 mi
Navajo Rd[6] BVCO S, 0.15 mi	0.15 mi
Willow St 11th/8th	0.40 mi
Yucca Loma Rd Apple Vly Rd/Navajo Rd	3.00 mi
Cucamonga & Demens Cr[7] Baseline N/Harritage Park	3.50 mi
Sunburst Ave SH 62/Joshua Tree Elem Sch	0.50 mi

Two Mile Rd - Bike Path H10450 Adobe Rd/Luckie Ave (S side)	0.87 mi
Navajo Rd - Bike Path H10448 Pau-ute Ave/Nisqually Rd (east side)	0.45 mi
Navajo Rd - Bike Path H10836 Apple Vly HS/Tussing Ranch Road	2.00 mi
Total	69.97 mi

PROPOSED BIKEWAYS (FUNDED)

Big Bear North Shore (USFS)[3] H10830 0.97 mi W/O Standfield CO W 1.18 mi (Scheduled April 1989)	1.18 mi

Footnote: Maintained by:

[1]County Service Area #82 (Searles Vly)

[2]County Service Area #19

[3]U.S. Forest Service

[4]City of Ontario

[5]State Department of Water Resources

[6]Apple Vly High School

[7]Rancho Cucamonga (85-272)

Source: SB County Trans/Flood Control Dept, Program Mgt. Division

State Law enacted in 1975 under Senate Bill 821 requires that 2% of the Countywide Local Transportation Fund (LTF) be set aside for improvement of pedestrian and bicycle facilities. LTF funds are derived from one-fourth cent of the

six cent retail sales tax and the 2% share provides between $250,000 and $500,000 annually for the SB 821 program. The Transportation Department coordinates the grant program for the unincorporated areas. The program for San Bernardino County is administered by SANBAG under guidelines established by the State and SCAG.

Each year around the end of December, SANBAG requests project proposals from the cities and the County for inclusion in the following year's program. Approximately 60 days are provided for submittal of completed project information forms. During this time period, the County Transportation Department solicits input for potential projects from various sources including Board members. The Department maintains an inventory of potential projects, which includes unfunded prior year projects and those received throughout the year for use in developing the County's annual program.

In April the projects that have been submitted to SANBAG are evaluated and prioritized by a selection committee made up of city and County representatives. This evaluation is based on a Project Evaluation Point System (copy attached). Projects which qualify for funding under the point system generally serve several major trip generators such as public facilities and commercial centers (schools, libraries, recreation areas). In addition, safety projects and projects which close gaps in existing facilities and/or are cooperative projects with other governmental jurisdictions usually rate high in the evaluation process.

The list of selected projects are then reviewed by the County Transportation Technical Advisory Committee (TTAC), the County Transportation Commission and finally SCAG. This process usually takes two to three months which means that authorization to begin work is not granted until around July.

12. Pedestrian Facilities

Pedestrian facilities form an integral part of the overall transportation network. Safe pedestrian facilities are needed to minimize the number and severity of traffic accidents involving pedestrians. Pedestrians are slow and fragile as compared to motor vehicles; a collision between a vehicle and a pedestrian almost inevitably results in at least

an injury, often a fatality. The pedestrian population includes many persons who are not familiar with traffic laws (one does not need to pass an examination to become a pedestrian, as well as lame, deaf, blind, or wheel-chair restricted persons; they may either take actions likely to result in accidents, or may be unable to avoid them. The discussion of the SB 821 Program in the Bicycle Facilities section above also applies to pedestrian facilities.

13. Traffic Analysis and Levels of Service

In order to evaluate highways needed to accommodate both current and future traffic, highway capacities can be evaluated using certain criteria. Highway capacity, or the maximum number of vehicles that can be accommodated, and the relationship to the demand for travel can be expressed by level of service criteria. As the amount of traffic approaches the capacity of any given highway, the free flow of traffic deteriorates rapidly. Generally, congestion occurs at 90 percent or more of the capacity figure, resulting in unstable traffic flow and considerable fluctuations in speeds.

Level of service analysis is used to evaluate congestion and delay on streets and highways. The relative level of congestion is evaluated on a scale from A through F. Level of Service A indicates free-flow conditions with no delay. Level of Service F indicates breakdown of the system with very long delays. Level of Service D is typically considered by many jurisdictions to be the worst acceptable level in an urbanized area. Beyond Level of Service E, capacity has been exceeded, and arriving traffic will exceed the ability of a given highway to handle traffic efficiently. A description of the meaning of the six Levels of Service (LOS) is as follows:

Levels of Service (LOS)	Volume of Capacity, Description
A	Volume is 0-60% of capacity, no physical restriction on operating speeds.
B	Volume is 61-70% of capacity, stable flow with few restrictions on operating speed.

C	Volume is 71-80% of capa stable flow, higher vo and more restrictions on and lane changing.
D	Volume is 81-90% capacity, approaching uns flow, little freedo maneuver.
E	Volume is 91-100% of capa unstable flow, lower oper speeds than LOS D, momentary stoppages.
F	Volume is greater than 10 capacity, forced flow opera at low speeds where the hi acts as a storage area there are many stoppages.

The County of San Bernardino aims to achieve L for highway links (the portion of highways bet two intersections), and to maintain LOS C thr intersections. The level of service at intersections, however, is invariably lower highway links due to cross traffic, tur movements, and traffic signals.

Another similar method of traffic analysis is Volume-to-Capacity Analysis. This also util LOS on a scale from A through F, linking the to volume/-capacity ratios as shown in Figure

Average daily traffic (ADT) counts for streets highways are recorded by the various cities their jurisdictional areas, by Caltrans for S highways and freeways, and by the County unincorporated areas. The County Traffic Divi of the Transportation/Flood Control Depart maintains a County traffic census, which recently been updated with projections for year 2007 as part of the Noise Element of General Plan Update. The ADT projections w calculated using 1988 traffic volume expans factors. Figure 11 indicates 1988 traffic vo expansion factors for selected roads around County; the County average is a factor of 1. for the 10-year period to 1998, and 2.243 for 20-year period to 2008. Attachment A at the of the Transportation/Circulation section th

Interpretation of Levels of Service for Freeways and Arterials

Level of Service *	V/C (Volume-to-capacity ratio)	Interpretation (During Peak Periods)
"A"	< = 0.75	Excellent operation, relatively free flow, average speeds 30 mph (constrained only by roadway alignment and/or speed limits).
"B"	0.76-0.88	Very good operation, stable flow, slight delay at key intersections, average travel speed 25+ mph.
"C"	0.89-1.00	Good operation, stable flow, occasional delay and intervehicular conflicts at many intersections, average speed reduced to 20+ mph.
"D"	1.01-1.13	Fair operation, approaching unstable flow, delays at critical intersections as long as two or more signal cycles, average speed as low as 15 mph.
"E"	1.14-1.25	Poor operation, unstable flow, continuous backups occur on the approaches to critical intersections, traffic from minor cross streets has difficulty entering or crossing main traffic stream, average speed likely to be at or below 15 mph.
"F"	> 1.25	Forced flow, vehicles backup from critical downstream signal through upstream signalized intersections. Stop and go conditions. Average speed less than 10 mph.

* As defined in the National Academy of Sciences Highway Capacity Manual, 1965.

TRAFFIC VOLUME EXPANSION FACTORS
TRAFFIC DIVISION
TRAFFIC PLANNING & RESEARCH SECTION

JANUARY 1988

MASTER STATION	LOCATION	UPDATING FACTORS 1 YEAR	2 YEAR	3 YEAR	4 YEAR	5 YEAR	PROJECTING YEARS 10 YEARS	20 YEARS
C1	Central Ave N/ Francis Ave.	1.044	1.089	1.136	1.186	1.240	1.538	2.366
C2	Archibald Ave N/ Arrow Route	1.045	1.094	1.144	1.197	1.252	1.569	2.459
C3	Sierra Ave S/ San Bernardino Ave.	1.020	1.040	1.061	1.082	1.104	1.219	1.484
C4	Barton Rd E/ Mt. Vernon Ave.	1.045	1.092	1.141	1.193	1.246	1.553	2.414
C5	Base Line W/ Sterling Ave	1.042	1.088	1.131	1.179	1.228	1.509	2.277
C6	Lugonia Ave E/ Alabama St.	1.043	1.088	1.134	1.183	1.234	1.524	2.321
C7	Yucaipa Blvd. E/ Thirteenth St.	1.039	1.079	1.122	1.165	1.211	1.466	2.149
C8	SR18 E/ Crestline Interchange	1.047	1.096	1.148	1.201	1.257	1.583	2.195
C9	Hesperia Rd N/ Bear Valley CO	1.032	1.100	1.156	1.211	1.270	1.613	2.603
10	29 Palms Hwy E/ Old Woman Springs Rd	1.039	1.080	1.122	1.165	1.211	1.464	2.147
11	Archibald Ave N/ Edison Ave	1.048	1.098	1.151	1.206	1.264	1.526	2.555
12	Community Blvd. E/ Lenwood Ave	1.045	1.093	1.151	1.206	1.264	1.595	2.554
13	Trona Rd N/ Lake View Drive	1.034	1.068	1.106	1.143	1.182	1.397	1.952
14	Slover Ave W/ Sierra Ave.	1.030	1.061	1.093	1.126	1.159	1.344	1.806
15	Aqueduct Rd E/ Blythe Rice Rd	1.044	1.089	1.138	1.188	1.240	1.538	2.366
	COUNTY AVERAGE	1.041	1.084	1.129	1.176	1.224	1.501	2.243
	WEST VALLEY AVERAGE	1.038	1.077	1.118	1.161	1.205	1.452	2.109
	EAST VALLEY AVERAGE	1.043	1.088	1.135	1.183	1.234	1.524	2.321

BA-II-D-164

Figure 11

background appendix shows all County roads with existing (1987) and projected ADTs of 5000 or more for the year 2007, which was calculated from the 1988 traffic volume expansion factors.

C. Regional and Local Studies

1. SCAG Studies

SCAG has produced a number of studies in recent years in addition to the RTP and RTIP, which were discussed earlier. These studies deal with transportation and circulation issues from a regional perspective for the six county SCAG region. It is not the purpose of this report to detail the contents of the SCAG studies, but to make the reader aware of these studies and to indicate that transportation and circulation issues and alternative strategies are being actively pursued.

The SCAG studies of recent origin on the issue of transportation and circulation are as follows:

- Regional Mobility Plan, Preliminary Draft of Strategies, April 1988 (discussed in Section III).
- Choices For Action:
  Growth Management Plan
  Regional Mobility Plan
  Regional Housing Needs Assessment
- Cost of Congestion (Draft), December 1987.
- Prototype Transportation/Land Use Ordinance and Report, January 1987.
- Infrastructure Capacity Analysis: Highway, Street and Road Component, October 1985.
- RIVSAN II Study, 1987, which due to its relevance to the Valley area of San Bernardino is discussed below.

2. Subregional Studies

A number of traffic studies have been completed in San Bernardino County. In many instances the incorporated cities have done traffic studies for

their jurisdictional areas and for sub-areas in conjunction with a General Plan Circulation Element or a specific planned development. The County of San Bernardino has completed traffic studies on community plan areas, specific plan areas and on a subregion. Consideration has been given to a countywide traffic analysis system using computerized traffic modeling techniques in conjunction with the County Transportation Department, SANBAG, and the incorporated cities within the County. At this time this is a goal with the many details of participation, responsibilities, and the all-important funding of such a system to be worked out.

Traffic studies that have recently been carried out recently in San Bernardino County on a sub-regional level are:

- The SCAG RIVSAN II Study.
- Route 30 Alternative Analysis Report
- DKS Victor Valley Study.

These traffic studies are briefly discussed below:

SCAG RIVSAN II

The SCAG RIVSAN II Study, 1987, for the San Bernardino County Valley area and western Riverside County, analyzes present and future transportation needs and capacity deficiencies and identifies problem areas. The RIVSAN II Modeling System approximated the aggregate transportation behavior and calculated the volume-to-capacity ratios to indicate where the traffic exceeded roadway capacity.

In an evaluation of traffic in the year 2010, a Null alternative and a Base alternative were developed. The Null alternative assumed no highway improvements up to 2010, while the Base alternative included all anticipated highway improvements. Travel behavior for both alternatives was assumed to remain the same as in the base year of 1984, with the number of trips and distribution of travel reflecting the area's growth as forecast in RIVSAN II.

The Null alternative shows the already congested major travel corridors becoming even more severely impacted by growth in the area. The main problem areas in or adjacent to San Bernardino County are

the I-10, SR-91, SR-60, I-215, SR-30, and the main north-south arterials in the Ontario/Upland area, and Milliken Avenue/Hammer Avenue. The City of Ontario and the Chino Hills unincorporated area were severely impacted, with deficiencies found on almost all roadways included in the highway network. Figure 12 shows the Null alternative and its impact on freeways and highways.

The Base alternative provides some congestion relief, but shows that there will still be capacity deficiencies in the highway system. Even with all the road improvements in place, the streets and highways would not be able to accommodate future peak-hour traffic demands in 2010. The I-10, SR-91, SR-60, and I-215 would still present traffic problems, as would major north-south arterials in the Ontario Airport vicinity. The impacts on traffic and congestion would, however, be to a lesser degree than the Null alternative. Figure 13 shows the impacts of the Base alternative on freeways and highways.

The RIVSAN II Study recommends a diversified strategy for dealing with the projected traffic problems as follows:

- Transportation System Management (TSM) to increase traffic flow on existing facilities through improvements such as signal synchronization, ramp metering/bypass lanes, removal of on-street parking, high-occupancy vehicle (HOV) lanes, etc., which represent low cost alternatives which can be implemented quickly.

- Transportation Demand Management (TDM) to implement tactics which encourage people to change their mode of travel or not make the trip at all, such as ridesharing, pricing incentives and disincentives, controlled parking management, and telecommunications.

- Improving Jobs-to-Housing "Balance" as a means of reducing total vehicle miles of travel (VMT) since residents would work closer to home. The "housing rich/job poor" RIVSAN area will continue to be so through 2010; job-to-housing balance could be promoted by identifying priority

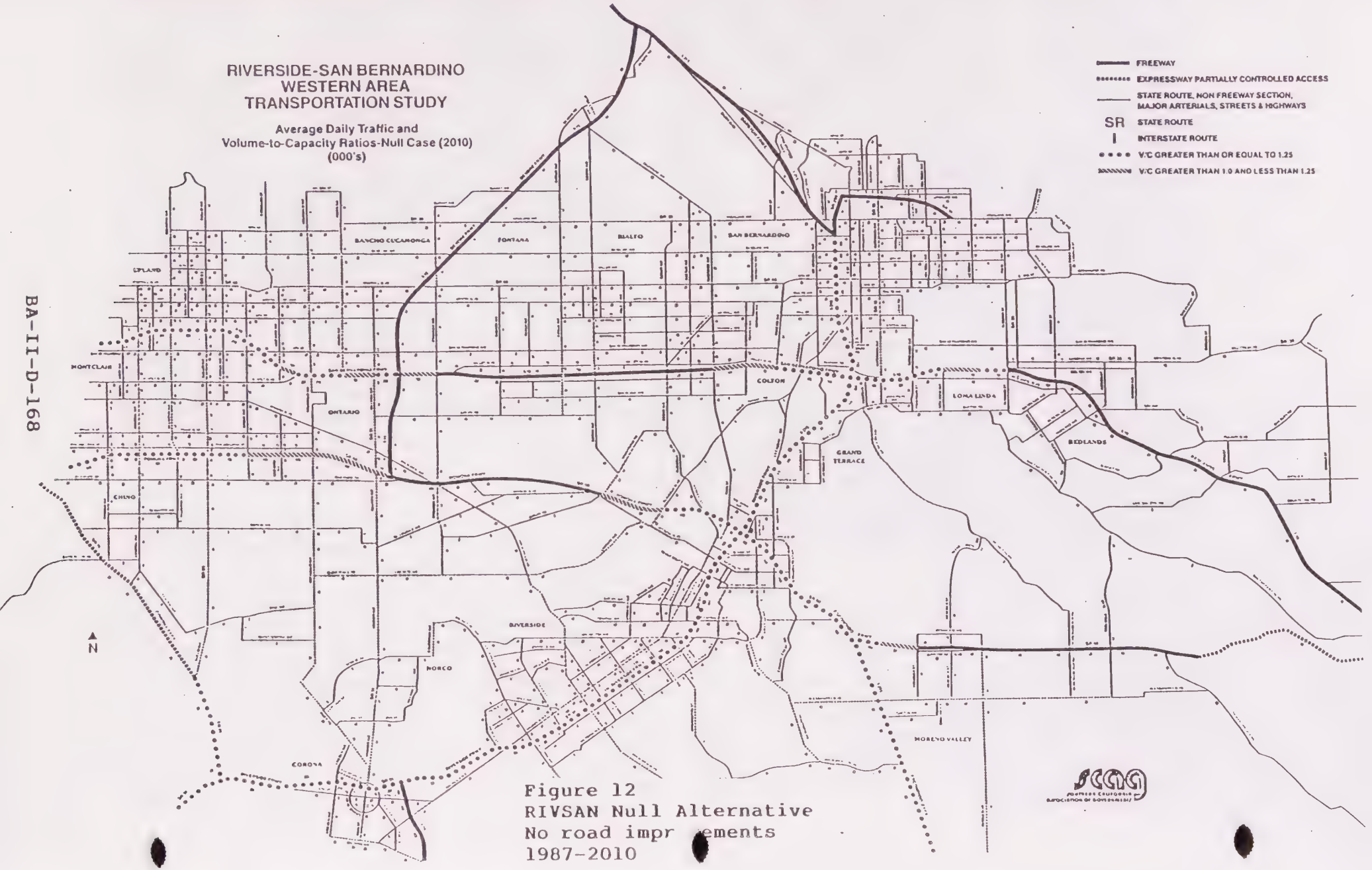


Figure 12
RIVSAN Null Alternative
No road impr ements
1987-2010

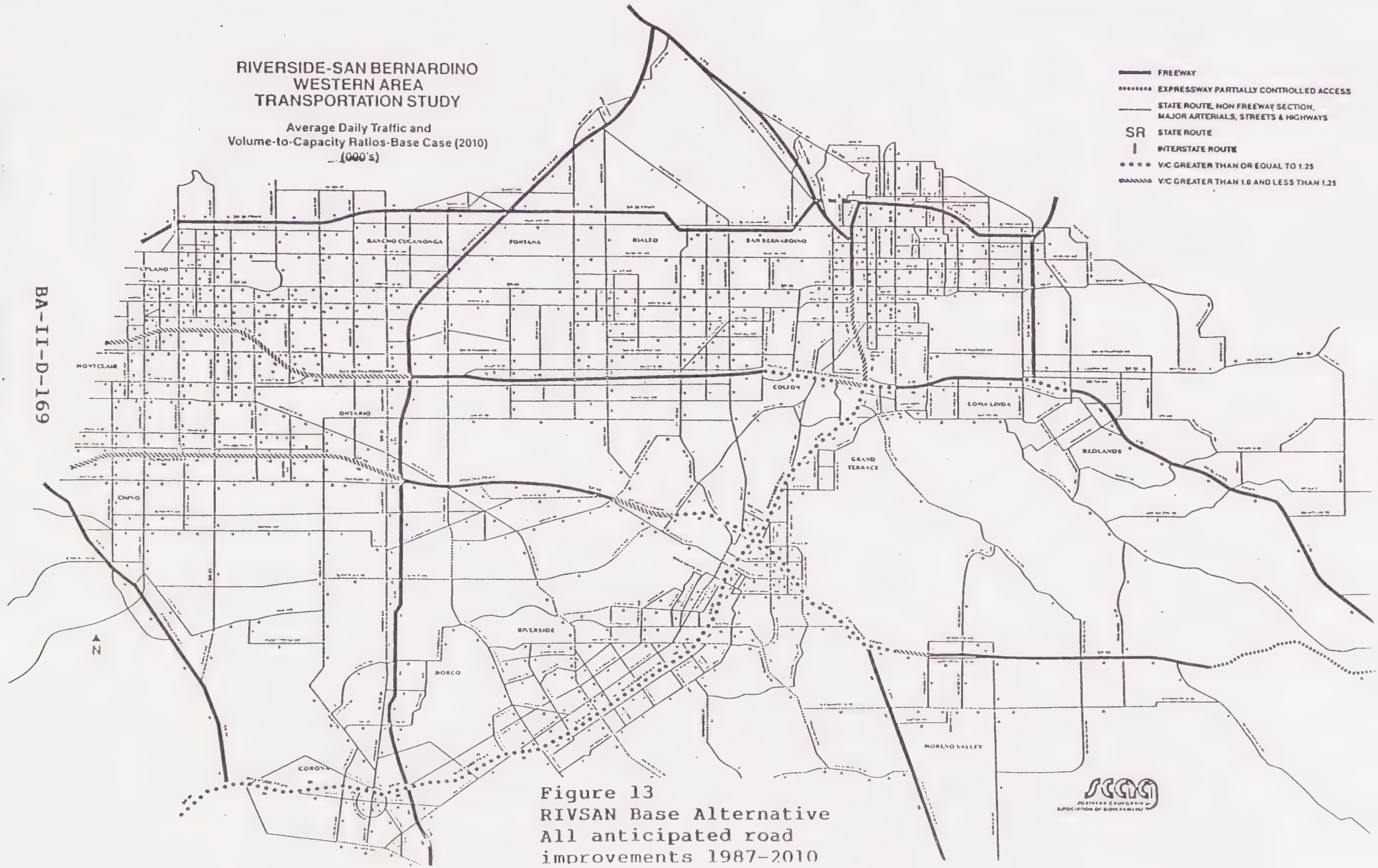


Figure 13
RIVSAN Base Alternative
All anticipated road
improvements 1987-2010

areas for receipt of economic developm funds, encouraging development commercial and industrial are increasing levels of employment designated areas and redirecting housing to areas with high employment

- o New Corridors will be considered in next phase (RIVSAN III) to addre future highway capacity requirement The possible corridors being looked within San Bernardino County include:

  - a north-south corridor along Ced Avenue in Rialto and Bloomington fr Highland Avenue (SR-30) to t Riverside County line, which th swings westward to cross SR-60 a the I-15 and proceeds to SR-71 Chino.

  - a north-south corridor beginning a the Tennessee Avenue/I-10 junctic in Redlands, proceeding sout through San Timoteo Canyo nt Riverside County.

  - an east-west corridor beginning a SR-30 north of the I-10 in Redlands proceeding east to link with SR-3 in the Mentone area.

Figure 14 shows these possible long range corridor recommendations.

- o New Sources of Revenue will be necessary to remedy the major capacity deficiencies identified by RIVSAN II. It is unlikely that TSM, TDM, and jobs-to-housing "balance" efforts will solve all congestion. San Bernardino County's "Measure A" to increase the state sales tax by one-half cent for road improvements failed in November, 1987; the sales tax measure may be reintroduced in 1989.

- o Commuter Rail from Los Angeles to San Bernardino should be investigated.


LONG RANGE CORRIDOR RECOMMENDATIONS: RIVSAN AREA
I-215
I-15
FONTANA
SAN BERNARDINO
I-10
REDLANDS
SR-60
CHINO
RIVERSIDE
SR-71
SR-91
FREEWAY
INTERCHANGE
EXPRESSWAY PARTIALLY CONTROLLED ACCESS
STATE ROUTE. NON FREEWAY SECTION
MAJOR ARTERIALS. STREETS & HIGHWAYS
SR STATE ROUTE
I INTERSTATE ROUTE
FIRST TIER FUTURE CORRIDOR
SECOND TIER FUTURE CORRIDOR
EXISTING CORRIDOR

Figure 14

Route 30 Alternatives Analysis Report

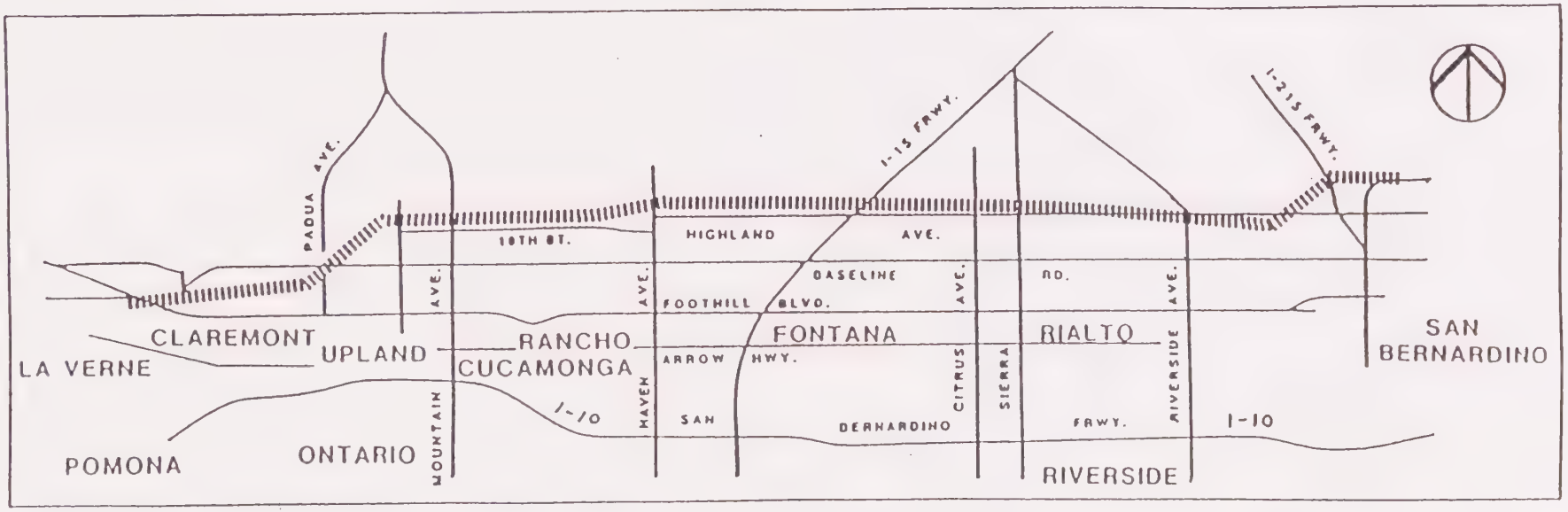
The Route 30 Alternatives Analysis Report, March, 1988, was prepared for Caltrans and SANBAG by Parsons Brinckerhoff Quade and Douglas, in association with several other consultants. The Route 30 Corridor parallels the foothills of the San Gabriel Mountains in Los Angeles and San Bernardino Counties. The Corridor traverses the San Bernardino County cities of Upland, Rancho Cucamonga, Fontana, Rialto, and San Bernardino (see Figure 15), and has been included in Caltrans' freeway/-expressway system plan for over 35 years. The report documents results of previous technical studies and identifies and evaluates the feasible alternatives for the Corridor in order to recommend one alternative.

Future travel deficiencies were developed for the year 2010 in the 30 Corridor utilizing sub-regional totals from Caltrans' LARTS (Los Angeles Regional Transportation System) model. The LARTS sub-region covered a much wider area than the Route 30 study area. Figure 16 shows the LARTS window area and the study area.

An evaluation of alternatives clearly shows that growth in the Route 30 Corridor will lead to extreme levels of congestion without a new facility. A LOS F can be expected for east-west roadways in the study area, including Baseline Road, 19th Street/Highland Avenue, Foothill Boulevard, Arrow Highway, and I-10, without a new facility or improvements to existing highways.

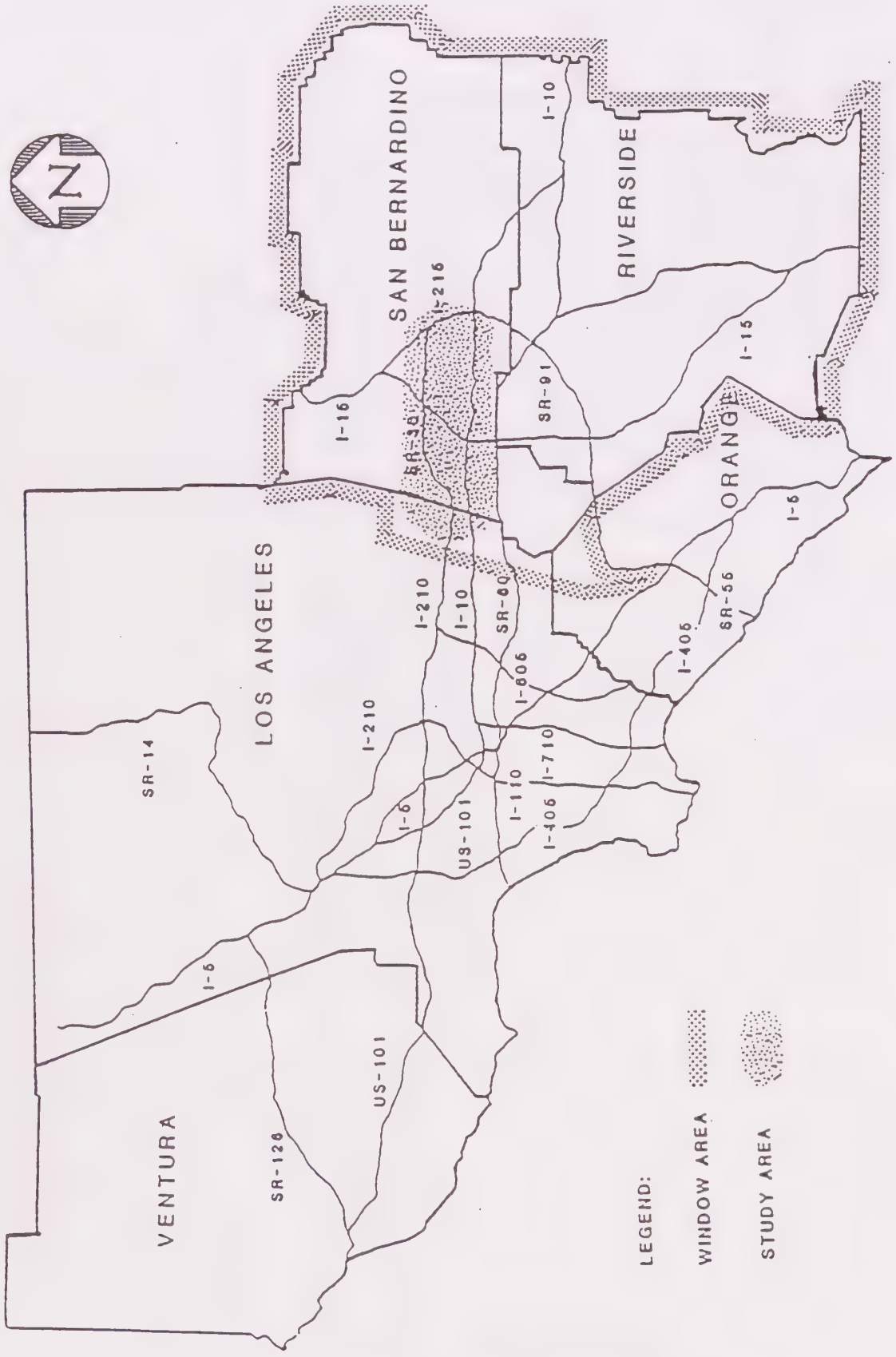
Three alternatives were identified for further consideration: a full freeway, a full expressway, and a freeway/expressway combination. The full expressway was eliminated as it would not accommodate projected volumes at LOS C for almost two-thirds of the Corridor. Furthermore, the freeway and freeway/expressway options would not by themselves provide the capacity to accommodate projected volumes at LOS C throughout the Corridor. The report calls for the consideration of HOV lanes in each direction to raise capacity on the freeway or freeway/expressway options. Neither of these

ROUTE 30 ALIGNMENT



Route 30 Alignment

Figure 15


N
VENTURA
LOS ANGELES
SAN BERNARDINO
RIVERSIDE
ORANGE
SR-14
I-5
SR-126
US-101
I-210
I-10
I-215
SR-30
I-16
SR-91
I-15
SR-60
I-605
I-405
SR-55
I-710
I-110
I-105
LEGEND:
WINDOW AREA
STUDY AREA

two options proved to be clearly superior, although the freeway option offers greater ability to accommodate growth beyond 2010. Nothing less than a freeway west of I-15 and an expressway east of I-15 would be adequate for Route 30 in 2010. A more extensive analysis of the freeway and freeway/expressway alternatives is recommended.

Victor Valley Circulation Study

Highways and roads, along with other public services and facilities, were examined in the Victor Valley area as part of San Bernardino County's Victor Valley Infrastructure Enhancement Program (VVIEP). This program studied the Victor Valley's high rate of growth and the provision of public services in order to develop a comprehensive approach to accomodating futuregrowth with the necessary urban services.

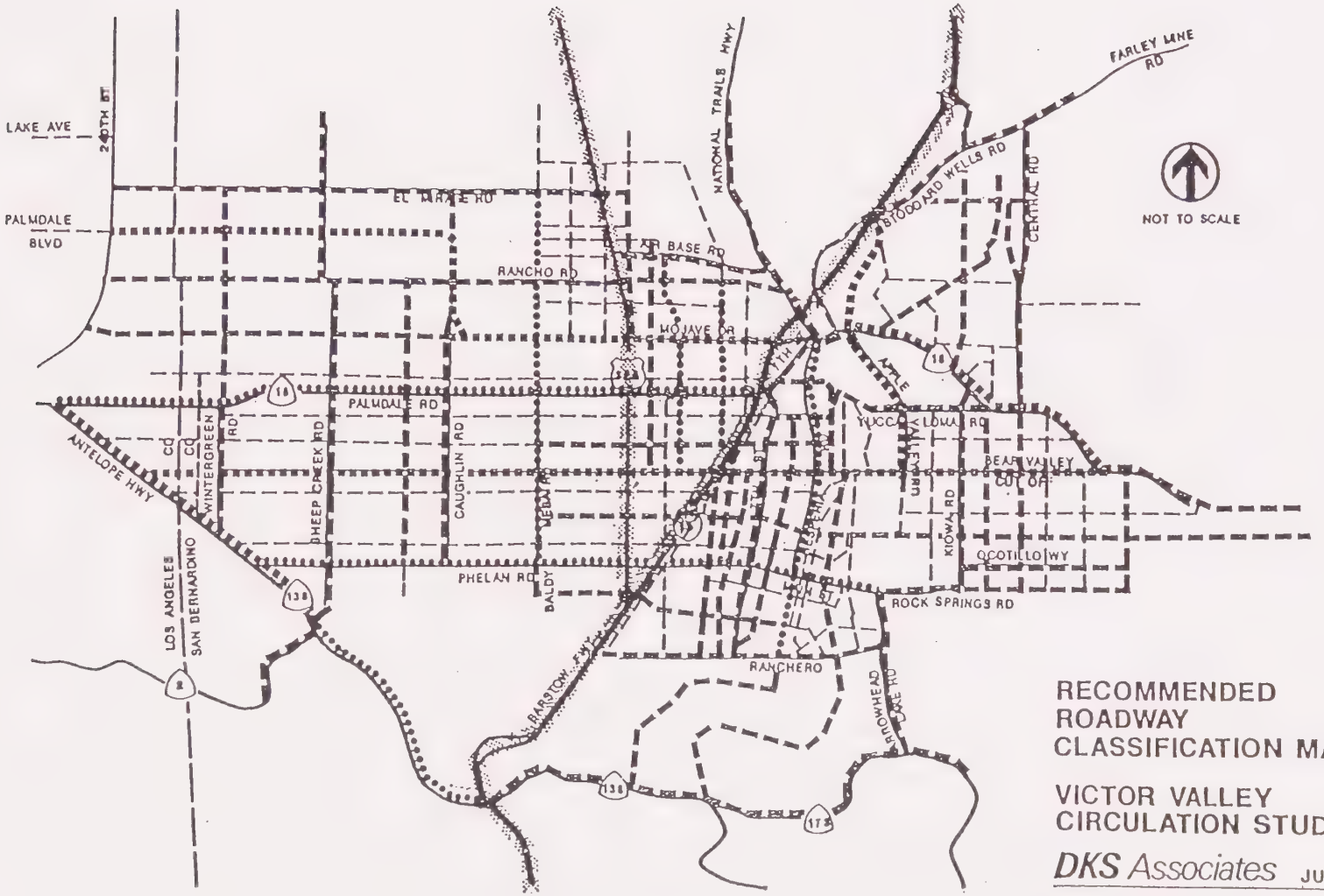
As part of the VVIEP traffic/road analysis component, SANBAG (in conjunction with San Bernardino County) retained DKS Associates to identify roadway infrastructure needs in the Victor Valley to the year 2010. This was accomplished by estimating year 2010 (and 1995) vehicular trips in the Valley by a mathematical, computer-based model. Both local and regionally oriented trips were estimated to provide realistic traffic projections. Regional trips were obtained from SCAG, Caltrans and other data sources. However, local trips were estimated directly within the model.

The model, which was calibrated to 1987 traffic levels, used land use estimates within the Valley for 1995 and 2010 (developed by other consultants) to estimate vehicular trips generated in each horizon year. These trips were distributed throughout the Valley based on the spacial distribution and compatibility of anticipated land uses. The trips were then assigned to the existing roadway network and a needs/deficiency analysis was completed. Roadway infrastructure needs identified for the Victor Valley to year 2010 were estimated to cost approximately 400 million in 1988 constant dollars.

The roadway needs/deficiency evaluation, completed under the guidance of the Roadways Subcommittee of the Victor Valley Infrastructure Committee, was an iterative process of identifying and testing alternative roadway improvement projects under acceptable traffic operation thresholds. The needs identified in this summary assume that acceptable traffic operating conditions include up to four hours of each week day where vehicle operators may have to wait more than one cycle length at major intersections. Though acceptance of greater delays would reduce this needs list and subsequent cost estimate, it was the consensus of the Roadways Sub-Committee that acceptance of greater delays would be inconsistent with the quality of life desired in the Valley.

Figure 17 shows the recommended roadway classification. Attachment B to the Transportation/Circulation section of this background appendix provides a detailed listing of recommended roadway infrastructure projects, phased at 7-year (1995), 12-year (2000) and 20-year (approximately 2010) planning horizons. Since these roadway infrastructure needs analyses are based on anticipated land use, this list should not be construed as absolute. Land patterns typically change in unanticipated ways. Therefore, this process is, by definition, dynamic. Nevertheless, this recommended list of projects should provide an indication of the relative magnitude of roadway infrastructure needs. A summary of the costs by geographical area and planning year phasing is indicated on Figure 18.

The High Desert Construction Industry Association has proposed a joint powers authority to formulate fees to fund needed road improvements in the Victor Valley area. The proposed Victor Valley Transportation Projects Agency would also investigate other alternatives to obtain funding, and would require participation by the cities of Adelanto, Hesperia, and Victorville, in addition to the County of San Bernardino.



RECOMMENDED ROADWAY CLASSIFICATION MAP

VICTOR VALLEY CIRCULATION STUDY

DKS Associates JUNE, 1988

FREEWAY
MAJOR ARTERIAL DIVIDED
MAJOR ARTERIAL
MAJOR HIGHWAY
SECONDARY

REV DEC 1988

NOTE: ADDITIONAL RIGHT OF WAY MAY BE REQUIRED IN ACCORDANCE WITH THE GENERAL PLAN, SPECIFIC PLAN, OR THE PROVISION OF ANY ORDINANCE WHICH HAS ESTABLISHED A FUTURE RIGHT OF WAY LINE. WHERE NONE OF THE FOREGOING EXIST, THE REQUIRED DEDICATION SHALL BE A FORTY-FOUR (44) FOOT HALF-WIDTH FROM SECTION LINES AND QUARTER SECTION LINES AND A THIRTY (30) FOOT HALF WIDTH FROM SIXTEENTH SECTION LINES.

Figure 17

BA-II-D-177

VICTOR VALLEY INFRASTRUCTURE ENHANCEMENT PROGRAM

ROAD NEEDS (BY YEAR): APPROXIMATE COST*

AREA	1995	2000	2010	TOTAL ($MIL)
COUNTY	14.4	116.6	57.9	188.9
VICTORVILLE	10.0	41.0	13.2	64.2
HESPERIA	12.9	36.9	35.6	85.4
APPLE VALLEY	18.3	18.1	9.2	45.6
ADELANTO	6.8	4.9	6.7	18.4
TOTAL (AREA)	62.4	217.5	122.6	$402.5

*COST IN 1988 DOLLARS

3. Local Studies

Yucaipa Area Transportation Facilities Fee Program

The Yucaipa transportation fee program was adopted on April 6, 1987 by the Board of Supervisors through Ordinance No.3132. The program provides a financing mechanism for the construction of roads and traffic signals to mitigate the impacts of accelerated development on the existing road system. Included in the benefit area are the communities of Yucaipa and Oak Glen, a portion of the Crafton area, and that portion of Calimesa within San Bernardino County. The boundaries of the plan and benefit area, and the proposed improvements are shown in Figure 19. Figure 20 shows Ordinance No. 3132.

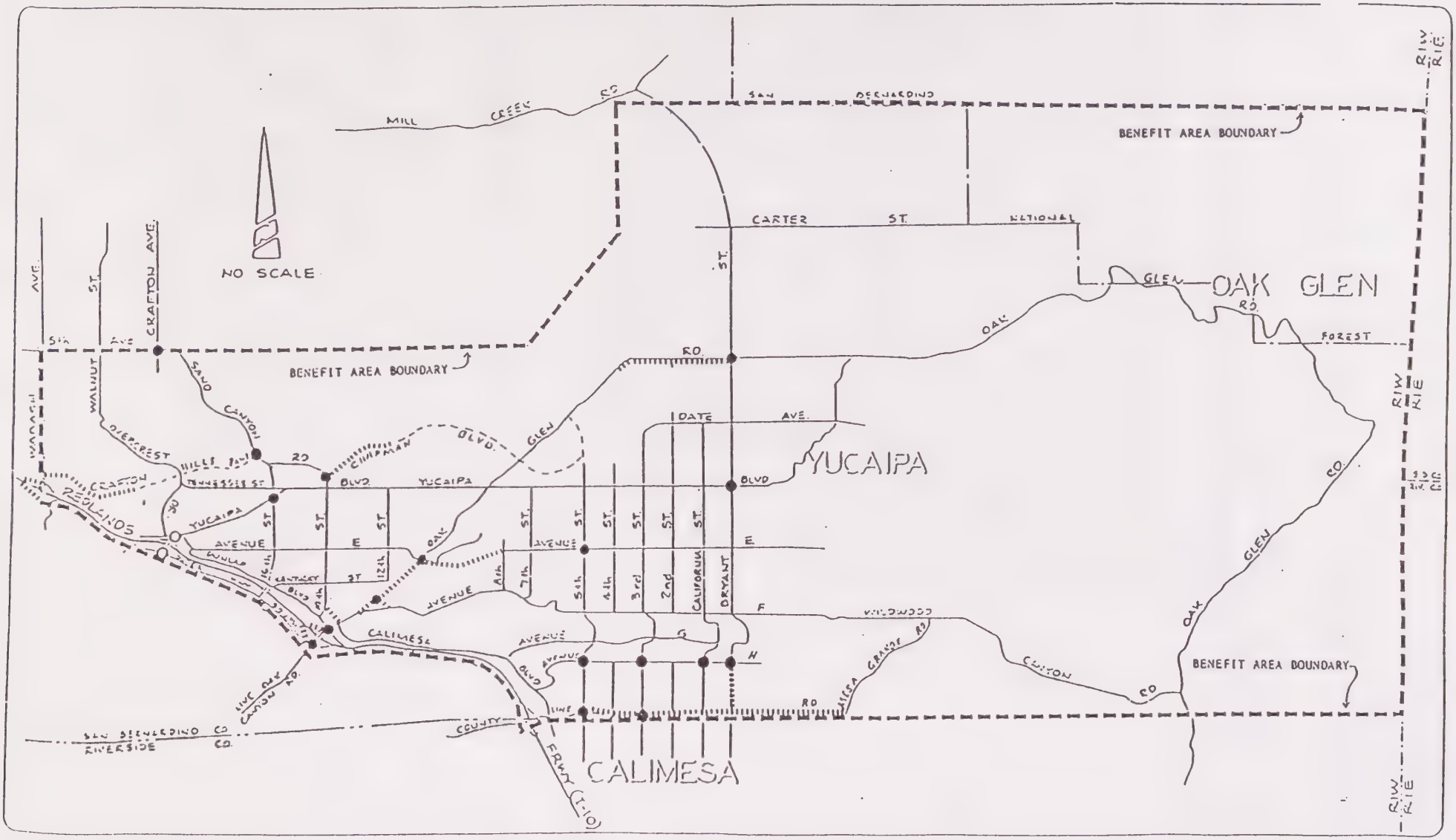
Transportation fees are apportioned within the plan area as follows:

- Commercial and Industrial Uses: $1537/acre
- Single Family Residential: $949/dwelling unit
- Multi Family Residential: $759/dwelling unit
- Mobile Home Residential: $427/dwelling unit

At present the fee program is undergoing its first annual review, and the fees may be adjusted to reflect changing conditions.

East Valley Corridor Specific Plan

A Circulation Plan Analysis was prepared by Ludwig Engineering consultants for the draft East Valley Corridor Specific Plan in the East Loma Linda/West Redlands area. The specific plan is nearing completion and is not yet finalized and approved at this time. County Service Area 110 (CSA 110), formed in 1984, will provide a mechanism for assessing property owners and developers in the specific plan area for needed infrastructure improvements, including roads and highways.



BA-II-D-180

LEGEND

- BENEFIT AREA BOUNDARY
- PROPOSED SIGNAL
- PROPOSED SIGNAL - FUNDED BY OTHERS
- PROPOSED ROADWAY IMPROVEMENTS
- PROPOSED ROADWAY IMPROVEMENTS - FUNDED BY OTHERS

YUCAIPA TRANSPORTATION FACILITIES
PLAN AND BENEFIT AREA

Figure 19

ORDINANCE NO. 3132

AN ORDINANCE OF THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, ADDING SUBSECTION (g) TO SECTION 16.0225, TITLE 1, DIVISION 6, CHAPTER 2; ADDING SUBSECTION (c)(2) TO SECTION 88.1120, TITLE 8, DIVISION 8, CHAPTER 11; AMENDING SECTION 813.0610, TITLE 8, DIVISION 13, CHAPTER 6; AND ADDING SECTION 813.0640, TITLE 8, DIVISION 13, CHAPTER 6, OF THE SAN BERNARDINO COUNTY CODE, RELATING TO ROAD FEES TO ASSIST THE FINANCING AND CONSTRUCTION OF ROADS AND TRAFFIC SIGNALS AND PROVIDING FOR THE COLLECTION OF SAID FEES IN THE UNINCORPORATED TERRITORY INCLUDED WITHIN THE BOUNDARIES OF THE TRANSPORTATION FACILITIES PLAN FOR YUCAIPA.

The Board of Supervisors of the County of San Bernardino, State of California, ordains as follows:

SECTION 1. The Board of Supervisors of the County of San Bernardino finds that:

(1) The Yucaipa community and surrounding environs including Oak Glen, Calimesa, and Crafton areas, will experience rapid growth.

(2) This growth will increase the need for additional transportation facilities.

(3) Lifting of the building moratorium will accelerate development and the need for transportation facilities if development is to continue in an orderly manner. Development of property in the Yucaipa Transportation Facilities Plan Area will require the construction of the transportation facilities specified by the plan.

(4) A financing mechanism is necessary if an equitable method of payment for the construction of the transportation facilities to mitigate potential failure of the existing road system is to be achieved.

(5) Only unincorporated portions of the County are within the Yucaipa Transportation Facilities Plan. In the event an incorporation of all or part of the Benefit Area occurs, appropriate revisions or arrangements shall be identified pursuant to Government Code Section 56000, et seq.

(6) Development fees in the plan are fairly apportioned within the Yucaipa Transportation Facilities Plan based on land use categories as follows:

1. Commercial and Industrial Uses
2. Single Family Residential
3. Multiple Family Residential
4. Mobilehome Residential

All other land uses are exempt.

(7) Failure to mitigate growth impact on transportation facilities within the Plan Area and the subdivisions therein will place residents of the Yucaipa Plan community in a condition perilous to their safety.

SECTION 2. Subsection (g) is added to Section 16.0225 of the San Bernardino County Code to read as follows:

(g) Local Area Transportation Facilities Plan Fees.

(1) Yucaipa Transportation Facilities Plan Fee Categories.

(A) Commercial and Industrial Uses ..... $1,537.00 per acre (i.e., 3½¢ per square foot)

(B) Single Family Residential ..... $949.00 per dwelling unit

(C) Multi-Family Residential ..... $759.00 per dwelling unit

(D) Mobile Home Residential ..... $427.00 per dwelling unit

SECTION 3. Subsection (c)(2) is added to Section 88.1120 of the San Bernardino County Code to read as follows:

(2) Public Services and Facilities Fees. The fee requirements of Division 13 of Title 8 of this Code shall be imposed as conditions of all map approvals, including parcel maps.

SECTION 4. Section 813.0610 of the San Bernardino County Code is amended to read as follows:

813.0610 Fee Payment.

(a) Except as otherwise provided in Sections 813.0625 and 813.0630, whenever a building or mobilehome setdown permit is issued within the boundaries of an adopted Local Area Transportation Facilities Plan, Transportation Facilities fees shall be required in the amount specified in the Schedule of Fees for such plan, and shall be paid within the time periods specified in Subsections (b), (c), and (d).

(b) Fees required pursuant to this Chapter as a result of a building permit shall be paid no earlier than the date of issuance of the building permit by the Office of Building and Safety, and no later than the date of final building inspection.

(c) Fees required pursuant to this Chapter for those mobilehomes not located within a legally established Mobilehome Park shall be paid no earlier than the date of issuance of the mobilehome setdown permit and not later than the date of the issuance of the Certificate of Occupancy.

(d) Fees required pursuant to this Chapter for those mobilehomes to be located within a legally established Mobilehome Park shall be paid no earlier than the date of issuance of the building permit for the construction of each space or combination of spaces, and no later than the date of final inspection for such spaces.

(e) The amount of the fee required shall be that which is in effect in the Schedule of Fees for the applicable Local Area Transportation Facilities Plan on the date of payment of such fees.

SECTION 5. Section 813.0640 is added to the San Bernardino County Code to read as follows:

813.0640 Subject Areas.

The provisions of this Chapter shall be applied only to unincorporated areas within the boundaries of Local Area Transportation Facilities Plans that have been established by the Board of Supervisors, and shall have no force or effect in any other portion of the County. These areas shall be as follows:

(1) The Yucaipa Plan area is established as follows: That portion of Sections 24, 25, and 26, and Sections 31 through 36, inclusive, Township 1 South, Range 2 West, SAN BERNARDINO MERIDIAN, and Sections 19 through 36, inclusive, Township 1 South, Range 1 West, SAN BERNARDINO MERIDIAN, and portions of Sections 1 through 12, inclusive, Township 2 South, Range 1 West, SAN BERNARDINO MERIDIAN, and that portion of the North half of Township 2 South, Range 2 West, SAN BERNARDINO MERIDIAN, lying North of Riverside County line and Northeasterly of Interstate Freeway Route 10, in the County of San Bernardino, State of California, described as follows:

Beginning at the Northwest corner of Block 24, Crafton Tract, as per map recorded in Book 3, page 14, records of said County; thence Easterly along the North line of Blocks 24 and 23, said Crafton Tract, to the Northwest corner of Lot 3, Block 78, Rancho San Bernardino, as per map recorded in Book 7 of Maps, page 2, records of said County; thence East, along the North line of said Lot 3, to the West line of said Section 32; thence East, along the North line common to said Sections 32 through 34, inclusive;

Thence Northeasterly, to the Southwest corner of Section 24, said Township 1 South, Range 2 West; thence North, along the West line of said Section 24, to the Northwest corner thereof; thence Easterly, approximately 7 miles, along the North line of said Section 24 and the North line common to Sections 19 through 24, inclusive, Township 1 South, Range 1 West, to the SAN BERNARDINO MERIDIAN; thence Southerly along said meridian, to the San Bernardino-Riverside County line, said point being also the Southeast corner of Section 12, Township 2 South, Range 1 West, SAN BERNARDINO MERIDIAN; thence West along said County line, to the Southwesterly right-of-way line of Interstate Freeway Route 10, as it now exists; thence Northwesterly, along said State Freeway right-of-way to the Redlands City Limits, now existing, said limits being also the West line common to Lots 5, 6, and 7, Block 27, of said Map of Rancho San Bernardino; thence North, along said City limits approximately one mile, to the point of beginning.

SECTION 6. This ordinance shall take effect sixty (60) days from the date of its adoption.

JOHN JOYNER, Chairman
Board of Supervisors

SIGNED AND CERTIFIED THAT A COPY OF THIS DOCUMENT HAS BEEN DELIVERED TO THE CHAIRMAN OF THE BOARD.

MARTHA M. SCUDDER
Clerk of the Board of Supervisors
of the County of San Bernardino

STATE OF CALIFORNIA
COUNTY OF SAN BERNARDINO } ss.

I, MARTHA M. SCUDDER, Clerk of the Board of Supervisors of the County of San Bernardino, State of California, hereby certify that at a regular meeting of the Board of Supervisors of said County and State, held on the 6th day of April, 1987, at which meeting were present Supervisors Jon D. Mikels, Barbara Cram Riordan, Larry Walker, Robert L. Hammock, John Joyner, and the Clerk, the foregoing ordinance was passed and adopted by the following vote, to wit:

AYES: Supervisors Mikels, Riordan, Walker, Hammock, Joyner.
NOES: None.
ABSENT: None.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the Board of Supervisors this 6th day of April, 1987.

MARTHA M. SCUDDER,
Clerk of the Board of Supervisors
of the County of San Bernardino,
State of California.

A preliminary Facilities Master Plan and Engineering Report was prepared by Metcalf and Eddy (January 1988) in order to determine the placement, design, and cost estimates for infrastructure, including roads and highways. Total capital costs for road improvements recommended in the Circulation Plan Analysis was estimated at $70.4 million. A financial plan will be prepared to further refine the costs of providing needed facilities and services, and to develop a program to finance the needed infrastructure.

Implementation of the specific plan will require the formation of a public agency under the auspices of the Joint Powers provisions of the California Government Codes. The agency will be empowered to implement the infrastructure and financing programs.

The recommended circulation plan will require amendments to and upgrading of many of the roads in the existing Consolidated General Plan. The draft circulation map for the East Valley Corridor Specific Plan is shown in Figure 21.

Other Local Studies

In addition to the traffic analysis studies discussed above, a number of cities in the County have recently or are currently preparing or updating circulation elements as part of a General Plan Update. This includes the cities of Victorville, San Bernardino, Rancho Cucamonga, Redlands, Chino, and Fontana. The recently incorporated cities of Highland, Twentynine Palms, and Hesperia will also be preparing new General Plans. The County's Transportation/Circulation Element will utilize the most recent information from city circulation studies in dealing with road designations in the adjacent unincorporated County pockets of land, particularly in the Valley area. Road designations will be compatible with city designations to the maximum extent possible. Consistency between City and County road standards was discussed earlier.

EAST VALLEY CORRIDOR SPECIFIC PLAN

CIRCULATION MAP

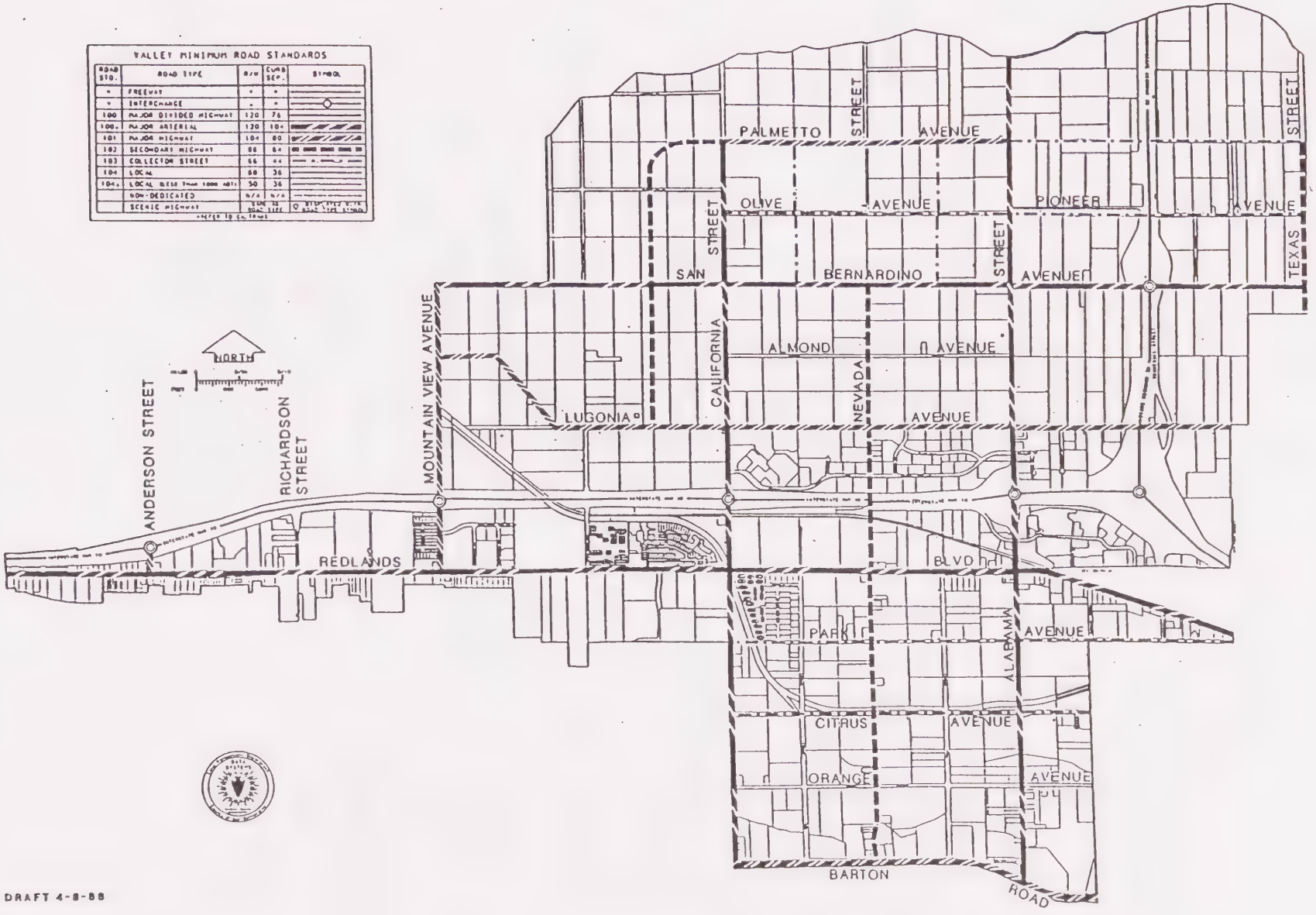


Figure 21

Glossary

AASHTO	-	American Association of State Highway and Transportation Officials.
ADT	-	Average Daily Traffic.
AQMP	-	Air Quality Management Plan.
Arterial	-	A main highway that is a through street.
CAAP	-	California Aid to Airports Programs.
Caltrans	-	State of California Department of Transportation.
CMRS	-	County Maintained Road System.
Collector Road	-	A street used by traffic to travel from local streets to secondary or major highways; usually it allows direct access to abutting properties.
CTC	-	California Transportation Commission; also used for County Transportation Commission.
DSMP	-	District System Management Plan (Caltrans)
FAI	-	Federal Aid Interstate Program.
FAP	-	Federal Aid Primary Program.
FAU	-	Federal Air Urban Program.
FHWA	-	Federal Highway Administration.
Freeway	-	A multilane highway with full grade separation (i.e., intersections are separated by under or overpasses), median strips and fencing or landscaping strips along the sides. It basically services intercity and interstate traffic.

Infrastructure	-	The basic utilities and services necessary to support development, e.g., sewer, water, and roads.
JPA	-	Joint Powers Agreement.
LARTS	-	Los Angeles Regional Transportation System Model
LOS	-	Level of Service.
Mag-Lev	-	A proposed high speed rail line between the cities of Ontario and Las Vegas.
OIA	-	Ontario International Airport.
RCR	-	Route Concept Reports (Caltrans).
RDP	-	Route Development Plans (Caltrans).
STIP	-	State Transportation Improvement Program, prepared by Caltrans.
TDM	-	Transportation Demand Management.
TIP	-	Transportation Improvement Program.
TSM	-	Transportation System Management.
UMTA	-	Urban Mass Transit Authority.
VMT	-	Vehicle miles of travel.
VVIEP	-	Victor Valley Imfrastructure Enhancement Program.

ATTACHMENT A

County Roads Existing ADT and Project ADT 1987-2007
(with projected of 5000 or more)

Street	Reach	1987 ADT	2007 ADT
A Street	N SH40 WB Ramps	2500	6700
Adobe Road	S 29 Palms Hwy SH62	3600	7800
Adobe Road	N 29 Palms Hwy	12100	26000
Agua Mansa Road	W Riverside Ave	4100	6100
Alta Cuesta	S Base Line	6300	13300
Alta Vista Drive	S Outer Hwy 10 So	2900	6200
Amargosa Road	N La Mesa Road	4900	12700
Apple Valley Road	S Muni Rd	3100	8000
Aqueduct Road State Highway MA	E Riverside County Line	3500	8500
Archibald Avenue	N Highland Ave	5400	13200
Arden Avenue	N Pumalo St	6800	15400
Arden Avenue	S Pumalo Street	7600	17200
Arrow Route	W Archibald Ave	4200	10200
Arrow Route	E Vineyard Ave	7600	18600
Arrow Route	E Archibald Ave	10900	26800
Arrowhead Lake Road	S Rock Springs Rd	5300	13800
Avenue E	E Third Street	6200	13400
Avenue E	E California St	4100	8900
Avenue F	E Bryant St	3200	6800
Avenue F	E California St	3200	6900
Avenue F	E Third Street	5000	10700
Avenue G	W Sixth Place	3000	6400
Baker Boulevard	W SH127	5100	12100
Baker Boulevard	E SH127	5800	13700
Baldy Mesa Road	S Duncan Road	2100	5400
Barton Road	A T Sprr Bridge	8400	20300
Barton Road	W Michigan St	19800	47800
Base Line	W Church St	2200	5200
Base Line	E Utah Trail	2600	5500
Base Line	E Webster Street	2800	6400
Base Line	W Boulder Ave SH30	5000	11200
Bayberry Drive	W Pipe Line Ave	2300	5900
Bear Valley Cutoff	W SH18	6100	15900
Bear Valley Cutoff	E Amargosa Rd	23200	60400
Bear Valley Road	E SH395	2900	7500
Bear Valley Road	E Amethyst St	6000	15600
Bear Valley Road	E Cobalt Rd	6700	17400
Beryl Street	N Base Line	5200	12700
Beryl Street	N Nineteenth St SH30	5500	13500
Birch Road	S Main St	2500	6400
Bird Farm Road	W Pomona Rincon Road	2700	6800
Bird Farm Road	W Ramona Avenue	3300	8500
Bryant Street	S SH38	3200	6900
Bryant Street	S Avenue E	3300	7100
Bryant Street	S Yucaipa Blvd	4800	10300
C Avenue	N Lime Street	5700	14900
Cactus Avenue	S Highland Ave SH30	7900	11700
Cajon Boulevard	S Devore Rd	2100	5000
Cajon Boulevard	S E State St	5400	12300
California Street	S Redlands Blvd	2900	6600
California Street	N Avenue E	4200	8900
California Street	S Avenue F	4600	9900
California Street	N County Line Rd	5020	10800
Calimesa Boulevard	S Avenue J	6000	12900
Camino Norte	W Alta Cuesta	3400	8500

Street	Reach	1987 ADT	2007 ADT
Carnelian Street	N Wilson Avenue	4100	10100
Carnelian Street	S Banyan Street	4500	11100
Carnelian Street	N Banyan Street	4500	11200
Carnelian Street	S Nineteenth St SH30	14700	36200
Carnelian Street	S Base Line	16700	41100
Carnelian Street	N Nineteenth St SH30	17400	42800
Cedar Avenue	E Fourth Street	3600	7700
Central Avenue	W Tippecanoe 005M	3100	7100
Central Avenue	N Base Line	3200	7200
Central Road	S Bear Valley Co	1900	5000
Central Road	N:OH18N	2800	7200
Central Road	N Bear Valley Co	3500	9100
Central Road	S SH18:OHS	4900	12900
Cherry Avenue	S Foothill Blvd	6900	10300
Cherry Avenue	S Santa Ana Ave	4600	8300
Chino Avenue	W Grove Ave	2200	5600
Chino Avenue	E Euclid Ave	2800	7100
Chino Avenue	E SH71	3400	8600
Chino Avenue	W Peyton Dr	4900	12500
Chino-Corona Road	S Pine Avenue	3100	8100
Choiceana Avenue	N Main Street	2800	7300
Church Avenue	S Base Line	2400	5500
Church Avenue	N Fifth Street	2400	5600
Church Street	S 29 Palms Hwy	4300	9200
Corwin Road	N:OH 18 North	4100	10600
Cottonwood Avenue	S Bear Valley Co	2100	5500
Cottonwood Avenue	N Main St	2500	6500
Country Club Drive	W Mauka Ct	3700	9700
Country Club Drive	E Spring Valley Pky	4300	11200
County Line Road	E Bryant Street	4200	9100
Crafton Avenue	N SH38 Mentone Blvd	3000	6900
Crafton Avenue	N Fifth Ave	2800	6600
Crafton Avenue	S SH38 Mentone Blvd	4500	10500
Crafton Avenue	N Citrus Avenue	4800	10700
Crucero Road	N National Trs Hwy	5100	12100
Cunningham Street	N Fifth Street	3400	7600
Daggett Yermo Road	S Yermo Rd	2200	5700
Daggett Yermo Road	N Santa Fe Street	2600	6600
Daley Canyon Access Road	E Daley Canyon Rd	2400	5300
Darby Street	W Macy St	2400	5500
Darwin Avenue	S Pico St	2900	7000
Date Avenue	E Bryant Street	2200	5700
Date Street	E Golden Avenue	3600	8200
Davidson Street	E Tippecanoe Avenue	10100	23000
De Berry Street	E Mount Vernon Ave	3800	9300
Del Rosa Avenue	N Base Line	4200	9500
Del Rosa Avenue	S Foothill Dr	4200	9700
Del Rosa Drive	N Baseline	2400	5500
Del Rosa Drive	S Fifth Street	8500	19200
Devore Road	N SH15:Off Ramp	2500	5800
Division Drive	S Mountain Lane	2500	5500
Dumosa Avenue	N Yucca Trail	3000	6600
Duncan Road	W SH395	3200	8500

Street	Reach	1987 ADT	2007 ADT
Dunlap Blvd	N W Avenue F	4400	9400
E Street	S Hill Drive	3000	6900
E Street	N 42nd Street, 00004M	3500	8000
E Street	N 40th Street	4700	10600
East Main Street	E Valley Street	3300	8600
El Evado Road	S Dos Palmas Road	2700	7000
Eleventh Avenue	N Main Street	2200	5800
Eleventh Street	E Central Ave	5400	13300
Etiwanda Avenue	N Foothill Blvd	4400	11000
Etiwanda Avenue	N Base Line	4500	11100
Eucalyptus Avenue	E Peyton Dr	2700	6900
Euclid Avenue	S Vista Dr	3200	7800
Euclid Crescent East	N Twenty-Fourth St	2600	6500
Fifth Avenue	S Main St	2000	5200
Fifth Avenue	N Main St	2300	6000
Fifth Avenue	W Crafton Ave	4000	9400
Fifth Avenue	E Wabash Ave	4400	10300
Fifth Street	E Boulder Ave SH30	2800	6400
Fifth Street	N Yucaipa Blvd	3300	7200
Fifth Street	E Del Rosa Drive	4000	9100
Fifth Street	N County Line Rd	4700	10200
Fifth Street	W Webster Street	5000	11300
Fifth Street	E Del Rosa Dr	5800	13200
Fifth Street	W Lankershim Ave	7700	17500
Fontana Avenue	S San Bernardino Ave	3600	5300
Fontana Avenue	N Beech Ave	3600	5400
Fontana Avenue	S Beech Ave	3800	5600
Foothill Drive	W Sterling Ave	2400	5500
Forest Shade Road	N Pioneer Camp Rd	2500	5600
Forty-Second Street	E Third Avenue	3800	8700
Fourteenth Street	W Cole Ave	2300	5300
Fourteenth Street	S Yucaipa Blvd	4400	10200
Fourth Street	E Haven Ave	6500	15500
Fourth Street	E Archibald Ave	6800	16200
Fourth Street	E Waterman Ave	2500	5900
Fourth Street	S Yucaipa Blvd	3700	8000
Fourth Street	W Archibald Avenue	9300	19700
Francis Avenue	E Pipe Line Ave	2900	6100
Francis Avenue	E Ramona Ave	3500	7300
Ft Irwin Road	S OH15 N	2100	5300
Ft Irwin Road	S Irwin Rd	2700	6800
Ft Irwin Road	E Irwin Rd	4500	11600
G Avenue	S Main Street	3700	9600
Ghost Town Road	N Yermo Rd	3700	9400
Golden Avenue	N Eureka St	2600	6000
Golden Avenue	N Marshall Blvd	4700	10700
Golden Avenue	N Lynwood Drive	5100	11600
Grand Avenue	E Peyton Dr	2100	5300
Grand Avenue	W Pipeline Ave	2900	6200
Grass Valley Road	N Blue Jay Cutoff	4600	11300
Grove Avenue	N Pine Ave	2400	6100
Grove Avenue	S Kimball Ave	2600	6700
Grove Avenue	N Merrill Ave	2800	7200
Grove Avenue	N Kimball Ave	3300	6900
Grove Avenue	N Edison Avenue	4400	11300

	Reach	1987 ADT	2007 ADT
Grove Avenue	S Foothill Blvd SH66	11000	27200
Grove Avenue	N Ninth Street	13600	20200
Grove Avenue	S Ninth Street	23400	51[illegible]
Guthrie Street	N Eighteenth St	3700	8400
H Street	N Rimrock Rd	4200	10800
H Street	S SH15	5300	13600
Harrison Street	S Marshall Blvd	3100	7000
Harrison Street	N Lynwood Drive	3300	7500
Haven Avenue	N Foothill Blvd SH66	12100	25600
Haven Avenue	N Base Line	12700	26900
Haven Avenue	N Eighth Street	13700	29000
Haven Avenue	S Lemon Avenue	10000	24800
Hellman Avenue	N Base Line	4000	9700
Hellman Avenue	N Foothill Blvd SH 66	5700	13900
Hook Creek Road	E Cumberland Drive	3600	8000
I Avenue	S Danbury Avenue	4800	12400
Irwin Road	W Ft Irwin Rd	2000	5100
Jacaranda Avenue	N Carob Street	2500	6600
Jacaranda Avenue	N W Bear Valley Co	5500	14400
Jasper Street	N Roberds St	3000	8000
Joshua Lane	S Joshua Dr	2700	5800
Joshua Lane	N:Onaga Tr	2700	5800
Jurupa Avenue	W Live:Oak Ave 0010M	3600	6500
Jurupa Avenue	E Calabash Ave	3900	7000
Jurupa Avenue	W Sierra Ave	3700	6700
Kalin Ranch Drive	E Spring Valley Pky	7800	9800
Kasota Road	N SH18:OHN	4100	10700
Knapps Cutoff	E SH138	3700	8100
Kuffel Canyon Road	N SH18	2700	6000
La Crosse Avenue	N Barton Rd	5300	12800
Lake Drive	E Lake Gregory Dr	4800	10500
Lakeview Drive	S Vista Road	2300	6000
Lakeview Drive	N Vista Road	2200	5700
Larrea Avenue	N 29 Palms Hwy	3100	6700
Larrea Avenue	S W 2 Mile Road	3400	7300
Lenwood Road	S Main Street	2900	7400
Lincoln Avenue	N Lilac Street	9600	25000
Linden Avenue	S San Bernardino Avenue	3800	5700
Live:Oak Canyon Road	S:Outer Hwy 10 So	3700	7900
Locust Avenue	N Valley Blvd	3800	5600
Locust Avenue	N San Bernardino Ave	4500	6700
Los Serranos Road	S W SH71	5500	14200
Lugonia Avenue	W Nevada St	2300	5800
Lugonia Avenue Red Master Sta	E Alabama Street	10500	24400
Lynwood Drive	W Golden Ave	12600	28800
Lytle Creek Road	E Entrance to Ranger Station	4500	6700
Macy Street	N Darby St	4900	11200
Main Street	W Lenwood Rd	4000	10100
Main Street	W North Bound Ramps	14200	37000
Main Street	W 7th Ave	34900	90800
Maple Avenue	S Eucalyptus St	4100	10700
Maple Avenue	S Main Street	4900	12800
Maple Avenue	N Main St	5200	13600
Marygold Avenue	E Palmento Ave	3600	5400
Meridian Road	S SH18	2400	6200

Street	Reach	1987 ADT	2007 ADT
Merrill Avenue	W Grove Ave	2700	6900
Merrill Avenue	E Grove Ave	2800	7300
Merrill Avenue	E Euclid Ave SH83	3600	9100
Merrill Avenue	W Beech Ave	3800	5700
Merrill Avenue	W Poplar Ave	5000	7400
Mesquite Springs Road	N Two Mile Rd	3900	8400
Michigan Street	S Barton Rd	7700	18500
Miller Avenue	E Alder Ave	2500	5800
Mission Road	E Mountain View Ave	2400	5500
Moonridge Road	E SH 18	6400	14000
Moonridge Road	S Garstin Dr	9400	20600
Mount Vernon Avenue	S Grand Terrace Rd	6300	15300
Mount Vernon Avenue	N Grand Terrace Rd	7500	18200
Mount Vernon Avenue	N De Berry St	11200	26900
Mountain Avenue	S Yucca Drive	2700	7000
Mountain Avenue	S Eureka Street	2900	6500
Mountain Avenue	N Lynwood Drive	4000	9200
National Trails Highway	N Vista Rd	2100	5600
National Trails Highway	S Vista Rd	5000	12900
National Trails Highway	N Underpass 0050M	5400	14000
National Trails Highway	N Mojave River	7700	20000
Navajo Road	N Standing Rock Ave	4000	10400
Newberry Road	N Pioneer Road	2000	5100
Ninth Street	E Central Ave S Jct	3100	7700
Ninth Street	W Palm Avenue	3100	7000
Ninth Street	E Cunningham St	4100	9300
Ninth Street	E Grove Ave	6400	13500
Ninth Street	W Benson Ave	4900	12000
Nisqually Road	W Third Ave	4000	10400
North Bay Road	N Peninsula Dr	3100	6700
North Bay Road	N SH189	6000	13100
Oak Glen Road	W Bryant Ave	4000	8600
Oak Glen Road	W Bryant Street	4400	9500
Oak Glen Road	N Yucaipa Blvd	4700	10200
Olive Street	W Rancho Ave 0003M	2700	6600
Onaga Trail	W Joshua Ln	2700	5800
Onaga Trail	W Sage Avenue	4900	10600
Orange Street	S Highland Ave SH30	3400	7800
Orange Street	N Pacific Street	3200	7400
Outer Highway 10 So	W Alta Vista Drive	4500	10300
Outer Highway 18 North	E Navajo Rd	2100	5500
Outer Highway 18 North	W Kasota Rd	2300	6000
Outer Highway 18 North	E Rimrock Road	2500	6500
Outer Highway 71 South	S Carbon Cyn Rd SH142	2700	6800
Pacific Street	E Palm Avenue	4000	9200
Palm Avenue	N Orchid Dr	4900	11100
Palm Lane	N Third St	2300	5400
Palmetto Avenue	S Marygold Ave	3900	5700
Palo Alto Way	N Hilltop Blvd SH18	2800	6200
Park Boulevard	S 29 Palms Hwy	2400	5200
Parker Dam Road	N Aqueduct Road	2300	5400
Pawnee Road	N SH18 OHN	2600	6800
Peach Avenue	S Valencia St	2600	7000
Peach Avenue	N Main Street	3500	9200
Peninsula Drive	E Grassvalley Rd	2700	5900

Street	Reach	1987 ADT	2007 ADT
Pennsylvania Avenue	E SH18	3600	7900
Pepper Avenue	N Slover Ave	2400	5800
Peyton Drive	S Whirlaway Lane	4300	11000
Peyton Drive	S Chino Hills Pkwy	8500	21600
Peyton Drive	N Valle Vista Dr	4200	10700
Peyton Drive	N Grand Ave	10500	26900
Peyton Drive	S Rock Springs Rd	11400	29200
Peyton Drive	S Chino Ave	7100	18100
Peyton Drive	N Chino Ave	13800	35200
Peyton Drive	S SH71	17000	43300
Peyton Drive	N Chino Hills Pwy	9700	24700
Phelan Road	E SH138	2500	6600
Phelan Road	W Sheep Creek Rd	4500	11600
Phelan Road	W SH395	4800	12400
Phelan Road	W Baldy Mesa Rd	6300	16400
Philadelphia Avenue	W East End Ave	4300	11000
Phillips Boulevard	W Central Avenue	2700	5800
Phillips Boulevard	E East End Ave	2800	5900
Phillips Boulevard	W Ramona Avenue	3100	6600
Phillips Boulevard	W East End Ave	4200	8800
Pine Avenue	E El Prado Rd	2400	6100
Pine Avenue	E Chino-Corona Rd	7800	19900
Pipe Line Avenue	N Valle Vista Dr	5200	13400
Pipe Line Avenue	S Mission Blvd	5200	13300
Pipe Line Avenue	N Philadelphia Ave	4800	12300
Pipe Line Avenue	S Carbon Canyon Rd	11700	29800
Pomona Rincon Road	N Los Serranos Road	3500	8800
Prado Lane	E Reche Canyon Rd	2500	5900
Pumalo Street	W Del Rosa Ave	3500	7900
Pumalo Street	W Chiquita Lane	4200	9600
Rancherias Road	S SH18 So	3600	9400
Randall Avenue	W Cedar Avenue	3400	5100
Randall Avenue	E Hemlock	3500	5200
Randall Avenue	E Alder Ave	4800	7000
Reche Canyon Road	N Riverside County Line	6600	15900
Rialto Avenue	E Lena Road	4100	9200
Ridge Crest Road	N Bear Valley Cutoff	3000	7900
Rimrock Road	W H St	2700	6800
Rimrock Road	E H St	4500	11500
River Road	N Park Road	2300	5400
River Road	N W National Trails Hwy	2400	5800
Riverside Avenue	N Country Club Dr	6900	10200
Riverside Avenue	S Country Club Dr	8700	13000
Rochester Avenue	N Foothill Blvd SH66	3600	8900
Rock Springs Drive	E Scenic Ridge Dr	2900	6200
Rock Springs Road	W Kiowa Road	3700	8500
San Bernardino Avenue	E Locust Ave	4000	5900
San Bernardino Avenue	E Mountain View Ave	4400	10100
San Bernardino Avenue	E Alabama St	4900	11400
San Bernardino Avenue	W Alabama Street	5100	11800
San Bernardino Avenue	E Beech Ave	6800	10100
San Bernardino Road	E Grove Ave	8800	21700
San Timoteo Canyon Rd	S Barton Rd	2400	5700
San Timoteo Canyon Road	S E Allesandro Road	3600	8200

Street	Reach	1987 ADT	2007 ADT
San Timoteo Canyon Road	N Allesandro Rd	4200	9800
Santa Ana Avenue	W Locust Avenue	3000	5400
Santa Ana Avenue	W Cedar Avenue	3800	6800
Santa Fe Avenue East	S Walnut St	2100	5500
Sapphire Street	N Nineteenth St SH30	4600	11200
Scenic Ridge Drive	E Sunburst Tr	2600	6100
Scenic Ridge Drive	N Rocksprings Dr	2900	6200
Scenic Ridge Drive	N LA Cty Line	4400	9300
Scenic Ridge Drive	W Rimrock Ave	4900	10300
Second Avenue	S Main Street	4500	11700
Second Avenue	N Main Street	4700	12300
Seventh Avenue	N Lime St	2800	7500
Seventh Avenue	N Bear Valley Cutoff	4100	10700
Seventh Avenue	S Main St	4500	11800
Seventh Avenue	N Eucalyptus St	5700	15000
Seventh Avenue	S Eucalyptus St	8000	20800
Seventh Street	S Yucaipa Blvd	4300	9300
Sierra Avenue FTA Master Statn	S San Bernardino Ave	38200	56700
Silver Lakes Parkway	N Mountain Spgs Road	2000	5100
Sixth Street	E Waterman Ave	2600	5900
Sixth Street	E Tippecanoe Ave	3100	6900
Sixth Street	E Waterman Ave	3700	8400
Slover Avenue	E Cedar Avenue	3800	5700
Slover Avenue	W Cypress Ave	4300	7800
Slover Avenue	E Cherry Ave	9300	13800
Slover Avenue Master Station	W Sierra Ave	7800	14000
Spruce Street	W C Avenue	2500	6500
State Highway 18-State MA	E Crestline Interchange	12700	27800
State Street	S Cajon Blvd	4200	9600
State Street	W Silicon Avenue	4900	10300
State Street	N Highland Ave SH30	6500	14800
Sterling Avenue	N Marshall Blvd	4700	10600
Third Avenue	W Cajon Blvd	2600	5900
Third Avenue	N Main Street	2700	6900
Third Avenue	S Main St	3800	9900
Third Street	N Avenue H	2800	6000
Third Street	N County Line Road	3100	6600
Third Street	E Victoria Ave	7600	17300
Third Street	S Yucaipa Blvd	4600	10000
Thunderbird Road	E Rancherias Road	3700	9600
Tippecanoe Avenue	N Hardt Street	7900	19100
Topaz Street	N Base Line	3500	8600
Trona Road	N Athol Street	4500	8800
Trona Road	S Center Street	5200	10200
Trona Road Master Station	N So Trona Rd	4000	7700
Twenty-Fourth Street	E Euclid Avenue	2100	5200
Twenty-Third Street	E Mountain Ave	3000	7400
Utah Trail	S Amboy Road	2400	5100
Utah Trail	S 29 Palms Hwy	3000	6500
Valle Vista Drive	E Los Serranos Blvd	3000	7700
Valley Boulevard	E Cedar Ave	14500	21500
Valley Boulevard	W Alder Ave	19000	28200

Street	Reach	1987 ADT	2007 ADT
Victoria Avenue	N Third Street	2600	5800
Victoria Avenue	N Ninth St	9100	20800
Victoria Avenue	N Pacific St	6000	13800
Victoria Avenue	N Fourteenth St	10400	23600
Vineyard Avenue	N Carnelian St	5300	13000
Vista Road	W Helendale Rd	2900	7600
Vista Road	W National Trails Hwy	3900	10200
Vista Road	E Helendale Road	4000	10400
Waalew Road	E Corwin Road	2100	5500
Wabash Avenue	S Mentone Blvd SH38	3800	9600
Walnut Avenue	W Roswell Ave	3462	7300
Walnut Avenue	W Norton Ave	5800	14900
Walnut Street	W Hesperia Road	3400	8800
Waters Drive	W State Hwy 138	3600	7900
White Feather Road	S SH62	3600	7700
Whittram Avenue	W Calabash Ave	5000	7400
Wika Road	W Tuscola Road	2800	7200
Wilson Avenue	E Haven Ave	5400	13300
Yermo Road	E Dagget-Yermo Rd	3300	8400
Yucaipa Blvd	E Bryant Street	3700	8000
Yucaipa Blvd	E Fourth St	22500	48400
Yucaipa Blvd	E:Oak Glen Rd	12900	27700
Yucaipa Blvd	W:Oak Glen Rd	24200	52000
Yucaipa' Boulevard Master Sta	E 13th Street	26000	55800
Yucca Loma Road	E Kiowa Rd	4200	10900
Yucca Loma Road	E Apple Valley Rd	4600	11900
Yucca Mesa Road	N 29 Palms Hwy	3200	6900
Yucca Trail	E Del Monte Ave	2400	5100
Yucca Trail	E Indio Avenue	3500	7500
Yucca Trail	W Aster Avenue	5300	11300
Yucca Trail	E Sage Ave	8800	18900

ATTACHMENT B

Victor Valley Circulation Study, 1988:
Recommended Roadway Improvement Needs

VICTOR VALLEY CIRCULATION STUDY
RECOMMENDED MASTER PLAN/ROADWAY IMPROVEMENT NEEDS

	Route	Recommended Improvement	Anticipated Need (Years)	Master Plan	Estimated Cost ($ x 10^6)
1.	SR-395 from I-15 to El Mirage Road (and beyond)	6-lane major arterial	4 lanes in 7	Freeway	18.0
			6 lanes in 20		11.8
2.	SR-138 from County limits to Angeles Crest Highway	4-lane major	12	6-lane major arterial (divided)	5.2
3.	Duncan/ Bear Valley Road	6-lane crossing at I-15	7	6-lane major arterial (divided) entire length	8.0
		4-lane major from County line to SR-395; 6-lane major arterial (divided) from SR-395 to Apple Valley Road; and 4-lane major from Apple Valley Road to Navajo	12		28.9
		4-lane major from Navajo to SR-18	20		2.8
4.	Mesa/ Lemon/ Tussing Ranch Road	4-lane major from Baldy Mesa to Navajo (including I-15 inter-change)	20	4-lane major from Baldy Mesa to SR-18	38.9

VICTOR VALLEY CIRCULATION STUDY
RECOMMENDED MASTER PLAN/ROADWAY IMPROVEMENT NEEDS

	Route	Recommended Improvement	Anticipated Need (Years)	Master Plan	Estimated Cost ($ x 10^6)
5.	Rock Springs Road/ Roundup	4-lane major from Main Street to Navajo	12	4-lane major to Milpas	10.2
6.	Ranchero Road	4-lane major from I-15 to Arrowhead Lake Road	12	4-lane major	18.7
7.	Arrowhead Lake Road	4-lane major from Ranchero Road to Rock Springs Road	12	4-lane major from Rock Springs Road to SR-173	1.1
8.	Summit Valley Road	4-lane major from Ranchero Road to SR-173	12	4-lane major	11.5
9.	Mojave Drive	4-lane major from County Line to I-15	12	6-lane major arterial (divided) entire length	28.4
		6-lane major arterial (divided) from Highway 395 to I-15	20		2.7
10.	Palmdale Boulevard (SH-18)	4-lane major from Highway 395 to I-15	12	6-lane major arterial entire length	3.8
		4-lane major from County Line to Highway 395; and 6-lane major arterial from Highway 395 to I-15	20		15.3

VICTOR VALLEY CIRCULATION STUDY
RECOMMENDED MASTER PLAN/ROADWAY IMPROVEMENT NEEDS

	Route	Recommended Improvement	Anticipated Need (Years)	Master Plan	Estimated Cost ($ x 10^6)
11.	National Trails Highway	6-lane major arterial from Rancho Road to I-15	20	6-lane major arterial	0.8
12.	Rancho Road	4-lane major from SH-395 to National Trails Highway	20	4-lane major from approximately County Line to National Trails Highway	6.4
13.	La Mesa (Nisqually)	4-lane major from SR-395 to Industrial Boulevard (including over-crossing I-15)	12	4-lane major from Baldy Mesa to Industrial Blvd.	13.7
14.	Sitting Bull Road	2-lane road from Apple Valley Road to Rincon Road	20	4-lane secondary from Apple Valley Rd. to SR-18	0.6
15.	Phelan Road/ Main	4-lane major from Rt. 138 to I-15, including realignment of I-15/SR-395 link	12	6-lane major arterial from Route 138 to Rock Springs Road	11.3
		6-lane major arterial from I-15 to Rock Springs Road	20		6.4

VICTOR VALLEY CIRCULATION STUDY
RECOMMENDED MASTER PLAN/ROADWAY IMPROVEMENT NEEDS

	Route	Recommended Improvement	Anticipated Need (Years)	Master Plan	Estimated Cost ($ x 10^6)
16.	Green Tree Boulevard/ Yucca Loma Road	4-lane major from Hesperia Road to Apple Valley Road	12	4-lane major	10.2
17.	Air Base Road	4-lane major from SR-395 to Village Drive	20	4-lane major	3.5
18.	Joshua Street	4-lane major from SR-395 to Hesperia Rd.; and 2-lane road from Hesperia Rd. to East Santa Fe (including bridge over railroad)	20	4-lane major from I-15 to East Santa Fe	8.2
19.	El Mirage Road	2-lane road from Koala Road to SH-395	7	4-lane major from County Line to Adelanto Road	1.1
20.	Smoketree/ Mojave St./ Mauna Loa	2-lane road from SR-395 to Maple (including overcrossing of I-15)	12	4-lane secondary from Baldy Mesa Road to Hesperia Rd.	6.2
21.	Goss/ Goodwin/ Eucalyptus	4-lane secondary from SR-395 to Maple (including overcrossing of I-15)	12	4-lane secondary from Baldy Mesa to Hesperia Road	6.1

VICTOR VALLEY CIRCULATION STUDY
RECOMMENDED MASTER PLAN/ROADWAY IMPROVEMENT NEEDS

	Route	Recommended Improvement	Anticipated Need (Years)	Master Plan	Estimated Cost ($ x 10^6)
22.	Koala Road/ Baldy Mesa	2-lane road from El Mirage to Phelan Rd.	12	6-lane major arterial its entire length	2.7
23.	Amethyst	4-lane major from Bear Valley to Air Base Road	12	6-lane major arterial	8.2
24.	El Evado Road	4-lane major from La Mesa to Rancho	12	6-lane major arterial	5.7
25.	Industrial Boulevard	4-lane major from Seneca to Bear Valley	12	4-lane major	4.0
26.	Apple Valley Road	6-lane major arterial from Bear Valley to I-15 (including rebuilding North Stoddard Wells interchange)	4 lanes in 7 6 lanes in 12	6-lane major arterial (divided)	16.1 5.3
27.	Deep Creek Road/ Rincon	2-lane road from Bear Valley to Sitting Bull	20	4-lane secondary from Rock Springs Rd. to Yucca Loma	0.6
28.	11th Avenue	4-lane major from Ranchero Street to Nisqually	12	4-lane major	6.3
29.	7th Avenue	4-lane major from Ranchero Street to Green Tree	7	4-lane major	7.4

VICTOR VALLEY CIRCULATION STUDY
RECOMMENDED MASTER PLAN/ROADWAY IMPROVEMENT NEEDS

Route	Recommended Improvement	Anticipated Need (Years)	Master Plan	Estimated Cost ($ x 10^6)
30. 3rd Avenue	4-lane major from Ranchero Street to Green Tree	12	4-lane major	7.3
31. Hesperia Rd.	4-lane major from Ranchero Street to Bear Valley	7	6-lane major arterial from Ranchero Street to Highway 18	5.1
32. "I" Avenue	4-lane major from Ranchero Street to Bear Valley	12	4-lane major	5.1
33. Peach Avenue	4-lane secondary from Ranchero Street to Bear Valley	20	4-lane secondary	3.5
34. Navajo Road	4-lane major from Roundup to Highway 18	7	4-lane major	3.7
35. Kiowa	4-lane major from Roundup to Highway 18	7	4-lane major	5.0
			Subtotal	$365.8

VICTOR VALLEY CIRCULATION STUDY
RECOMMENDED MASTER PLAN/ROADWAY IMPROVEMENT NEEDS

TRAFFIC SIGNALS:

36. Approximately 95		12.0
	Subtotal	$12.0

URBAN INTERCHANGES/FLYOVERS:

Project	Anticipated Need	
37. Bear Valley/Hesperia Road	12 years	3.6
38. Apple Valley/Highway 18	20 years	3.5
39. SR-395/Mojave Drive*	20 years	3.5
40. SR-395/Palmdale Road*	20 Years	3.6
41. SR-395/Bear Valley*	20 years	3.5
42. SR-395/Mesa/Lemon*	20 years	3.5
43. SR-395/Phelan Road*	20 years	3.5
	Subtotal	$24.7
	TOTAL ESTIMATED COST (Constant 1988 Dollars)	$402.5

*Only if no freeway is provided along Highway 395 alignment by year 2010.

Note: Phasing suggested at this time is a function of the traffic generated by evaluation of both the 1995 and 2010 "High" land use scenarios developed by WCLC. Additional changes in Master Plan, provided graphically, are also recommended, but are not anticipated to require major construction prior to year 2010. Cost estimates provided were prepared by San Bernardino County Planning Staff.

ENERGY/TELECOMMUNICATIONS

ENERGY/TELECOMMUNICATIONS

I. INTRODUCTION

Energy and telecommunications are very important aspects of everyday life. We rely on energy in many forms such as food, oil, gas, and **electricity** to achieve work in living systems, business, and industry. A major use of energy is for the transportation of people and goods from place to place. Telecommunications allow the transfer of information electronically over long distances without requiring large energy expenditures to physically transfer the same information. Since both of these issues are interrelated and are essential for life in this civilization, this appendix will provide information valuable to improving the quality of life in San Bernardino County. By identifying and then promoting the best energy and telecommunications technologies and systems, economic prosperity and environmental quality can be enhanced.

This appendix is divided into two major discussion topics. First, the fundamentals of energy and ecosystems are presented with analyses of United States energy consumption habits and options for the future. Second, the current energy consumption situation in the County of San Bernardino is presented with projections of future energy demands. In addition, the natural resources within the County are investigated for potential energy sources.

A. Definition

1. The First and Second Laws of Thermodynamics

According to the first law of thermodynamics, also known as the law of **conservation** of energy,

> Energy is neither created nor destroyed by any physical or chemical process; it is merely transformed from one of its forms such as heat, light, mechanical, electrical, or chemical energy to another.

If a system loses or gains energy, then an equal amount of energy must be transferred in some form to or from the surroundings. In any process, the total energy of the system plus its surroundings remains constant. In other words, we can't get something for nothing.

In nature two types of processes are distinguishable: spontaneous processes, which can occur naturally without an outside input of energy, and nonspontaneous

processes, which require an energy input from the surroundings. The second energy law summarizes our observations about the direction of energy flow in spontaneous processes. Examples of spontaneous processes are objects falling to the ground, water flowing downhill, and heat flowing spontaneously from a hot body to a cold body.

The production of food, the manufacturing of various chemicals, clothes, shelter, and other supplies, the burning of **fossil fuels** to provide heat and cook foods all greatly increase the disorder of the environment. This disorder most often takes the form of heat (the disorderly, chaotic motion of molecules) and the conversion of relatively large fossil fuel molecules into smaller air pollutant molecules such as carbon monoxide, nitrogen oxides, and sulfur oxides.

> Any system plus its surroundings tends spontaneously toward increasing disorder, or randomness.

This is a statement of the second law of energy or thermodynamics.

Another statement of the second energy law is that no conversion of energy from one form to another is 100 per cent efficient. In other words, in any energy conversion, some energy is always wasted. As energy is transformed from one form to another, it is degraded into less and less useful forms until it becomes heat energy, which is the random motion of molecules. This chaotic, disorganized motion of molecules cannot be harnessed to perform useful work. A useful form of energy is one that has a high **capacity** for doing work.

For example, photosynthesis in plants converts solar energy to chemical energy, which is stored in the chemicals produced. If you eat plants such as lettuce, this chemical energy is transformed within your body to the energy of motion in muscles and other life processes, and heat energy is given off to the environment. Every energy step is inefficient and adds nonreusable waste heat to the environment. The end result is that all of the ordering processes necessary for life on our planet increase disorder, primarily as heat, in our lifesupport system. The ultimate pollutant in any closed lifesupport system is heat.

The ways in which man converts energy are particularly inefficient. For example, the efficiency of the internal combustion engine is about 22%. When we deduct friction losses, the automobile is only about 10

to 12% efficient; 88 to 90% of the gasoline or chemical energy used to drive the car is wasted and lost as heat to the environment. If we tried to design the most inefficient engine possible, we would be hard pressed to come up with a poorer one than the internal combustion engine.

The second energy law provides a key both for understanding energy management problems and for understanding how we must deal with them. It says that any increase in order in a closed system such as the earth will automatically and irrevocably increase the entropy, or disorder, in the environment.

Thus, paradoxically, the more we attempt to order, or "conquer" the earth, the greater the stress we inevitably put on the environment. Failure to accept the fact that we can't repeal the first and second laws of thermodynamics and that we must learn to live with the restrictions they impose on us can only lead to a steady and further degradation of the quality of life on this planet.

The ecological and human imperative that we must learn from the energy laws is simple and profound: Whenever you do anything, be sure to consider its present and possible future upset on your fellow human beings and on your environment. We must apply this imperative now if we are to prevent a drastic degradation of our lives.

2. Solar Energy

The source of the radiant energy that sustains all life on earth is the sun. The sun warms the earth and provides energy for photosynthesis in plants, which in turn provides the food or carbon compounds that sustain all life.

This radiant energy from the sun travels the 93,000,000 miles to earth at 186,000 miles per second in the form of electromagnetic waves with a whole range of energies. The higher energy, shorter wavelength rays--gamma rays, x-rays, and most ultraviolet rays--are harmful to life. Fortunately, various chemical molecules such as ozone in our present atmosphere absorb these rays and thus prevent them from reaching the surface of the earth. Without this atmospheric screening process, essentially all present forms of plant and animal life on this planet would be destroyed. The only portion of the solar energy spectrum used to support life is a narrow band in the visible spectrum. And this energy can be captured and used only by plants containing chlorophyll

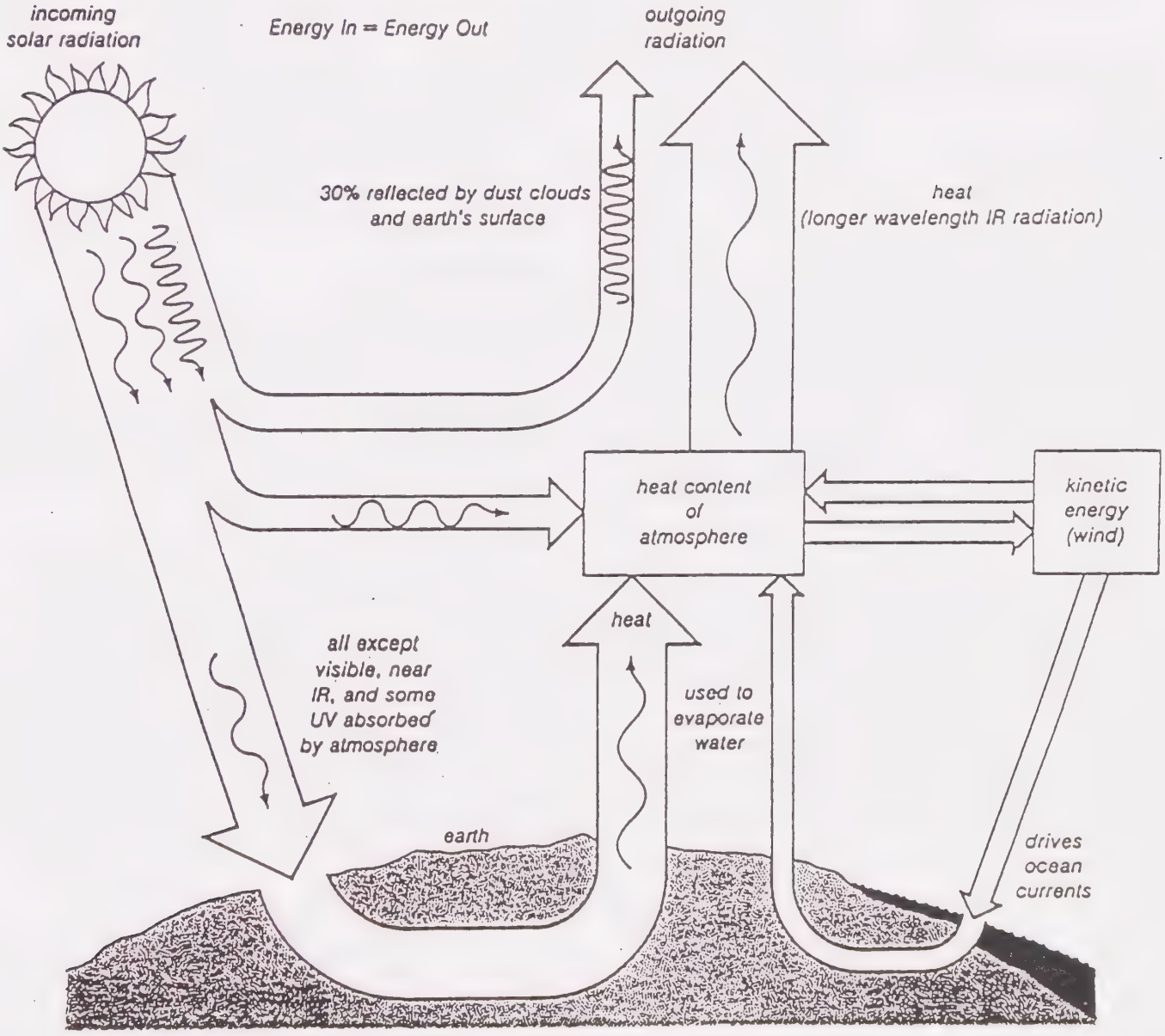
or chlorophyll-like substances. Even so, plants use 100 times more energy than that used by all man-made machines and make more efficient use of their share of the energy than any man-made machine does.

The first law of thermodynamics requires that eventually the earth must lose energy to space at the same rate that it received radiant energy from the sun. But although energy in must equal energy out, the useful short wavelength incoming solar energy is degraded to almost useless heat energy with a longer wavelength in accordance with the second law. The earth and its atmosphere can then be viewed as a giant thermodynamic engine driven by sunlight. (Figure 1)

The reflectivity and chemical composition of the atmosphere determine which wavelengths of energy will be absorbed and emitted. This in turn determines the average global temperature. Thus, changes in either the chemical composition or the reflectivity of the atmosphere can raise or lower the earth's average temperature. As a result, global climate patterns could be altered with serious consequences for man.

Natural processes such as volcanic eruptions and dust storms can alter the composition and properties of the atmosphere. The question of whether man's activities can alter global climate is receiving increasing attention. Man has been adding massive amounts of carbon dioxide and heat to the atmosphere by burning fossil fuels (gas, oil, coal). This has been postulated as leading to a gradual warming of the earth's atmosphere, commonly being called the **greenhouse effect**. A rise of 2^{o} **Celsius** (C) in average atmospheric temperature might cause major changes in global weather patterns and a 3^{o} to 6^{o} C rise could eventually melt the polar ice caps, thus flooding a large portion of the world. Man's activities might also cause a cooling of the earth's atmosphere through massive additions of soot, dust, and other particulate matter. Such cooling could even trigger a new ice age. The degree to which man may inadvertently be altering the global climate is a current subject of scholarly debate.

Figure 1. The Atmospheric Heat Balance



Ecosystems are dynamic, not static. By their very presence, organisms, and particularly man, continually alter local conditions. The biotic communities that make up an ecosystem are continually changing in response to environmental changes caused either by the communities themselves or by external stresses such as fires, flooding, erosion, farming, industrial pollution, and urbanization.

An ecosystem maintains its overall stability by three major mechanisms: 1) controlling the rate of energy flow through the system, 2) controlling the rate of chemical cycling within the system, and 3) maintaining a diversity of species and food webs so that the stability of the system is not affected seriously by the loss of some species or food web links. These principles of energy flow, chemical cycling, and species diversity can help us understand some of the major changes and problems that can arise in local, regional, or global ecosystems.

3. Fossil Fuel Resources

Nowhere is the potential collision between resources, people, and pollution more probable than in the United States (Park 1968). In attaining our present standard of well-being, we have used more minerals and fossil fuels during the last 30 years than all of the peoples of the world have used since the beginning of history (McKelvey 1972).

On a per capita basis, Americans use more natural resources than any other nationality. With only 6% of the world's population, we consume about one-third of all the world's resources. During 1972, the United States used about 4.2 billion tons of mineral and fossil fuel resources. This means that each American indirectly or directly used an average of 42,500 pounds of resources. Approximately half of this ended up as solid waste. Much of the remaining half will remain in circulation for several years before becoming waste or ending up as air and water pollution. Only a tiny fraction of these valuable resources was recycled or reclaimed.

How much longer can world and U.S. supplies of oil, natural gas, and coal last with energy demands escalating exponentially? There are a number of possible answers depending on the accuracy of estimated reserves, the potential for finding new deposits, and our rate of usage. However, there is one important difference. Metals and some other minerals can, in principle, be recycled, but energy cannot, because it flows through the ecosphere and cannot be used again.

M. King Hubbert (1969) has projected depletion curves for world (Figure 2) and U.S. supplies (Figure 3) of oil, natural gas, and coal. Some other observers (Fisher 1974, Peach 1973, Theobald et al. 1972, Skinner 1969) take a more optimistic view of fossil fuel supplies. Yet, even Hubbert's estimates may be too optimistic

because they consider total resource reserves and not net energy reserves. Major finds of new reserves or reduced usage rates merely shift the estimated depletion times a relatively short time into the future.

Figure 2. Estimated Depletion Curves for World Supplies of Fossil Fuels

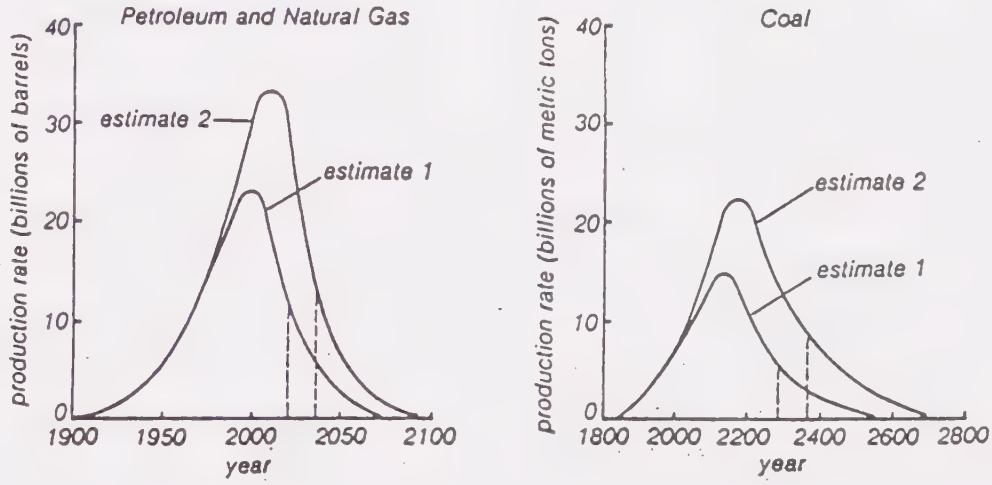
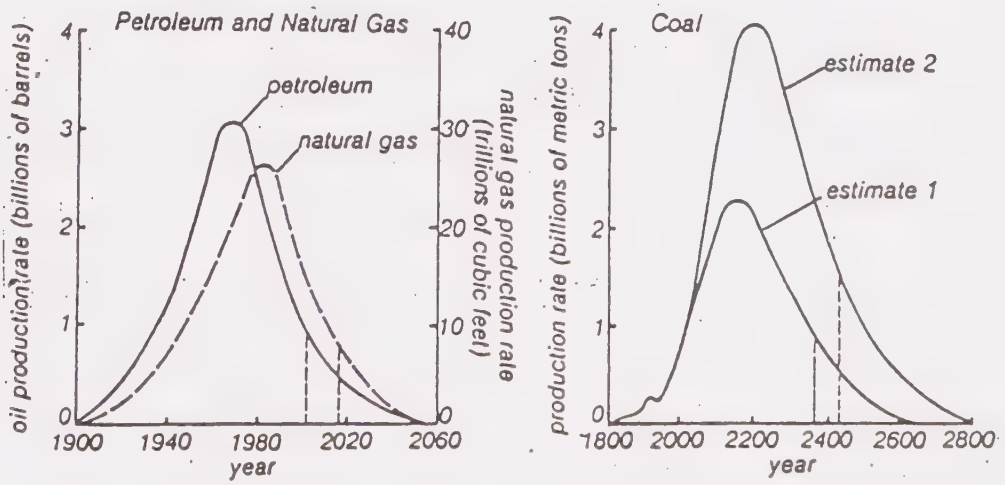


Figure 3. Estimated Depletion Curves for U.S. Supplies of Fossil Fuels



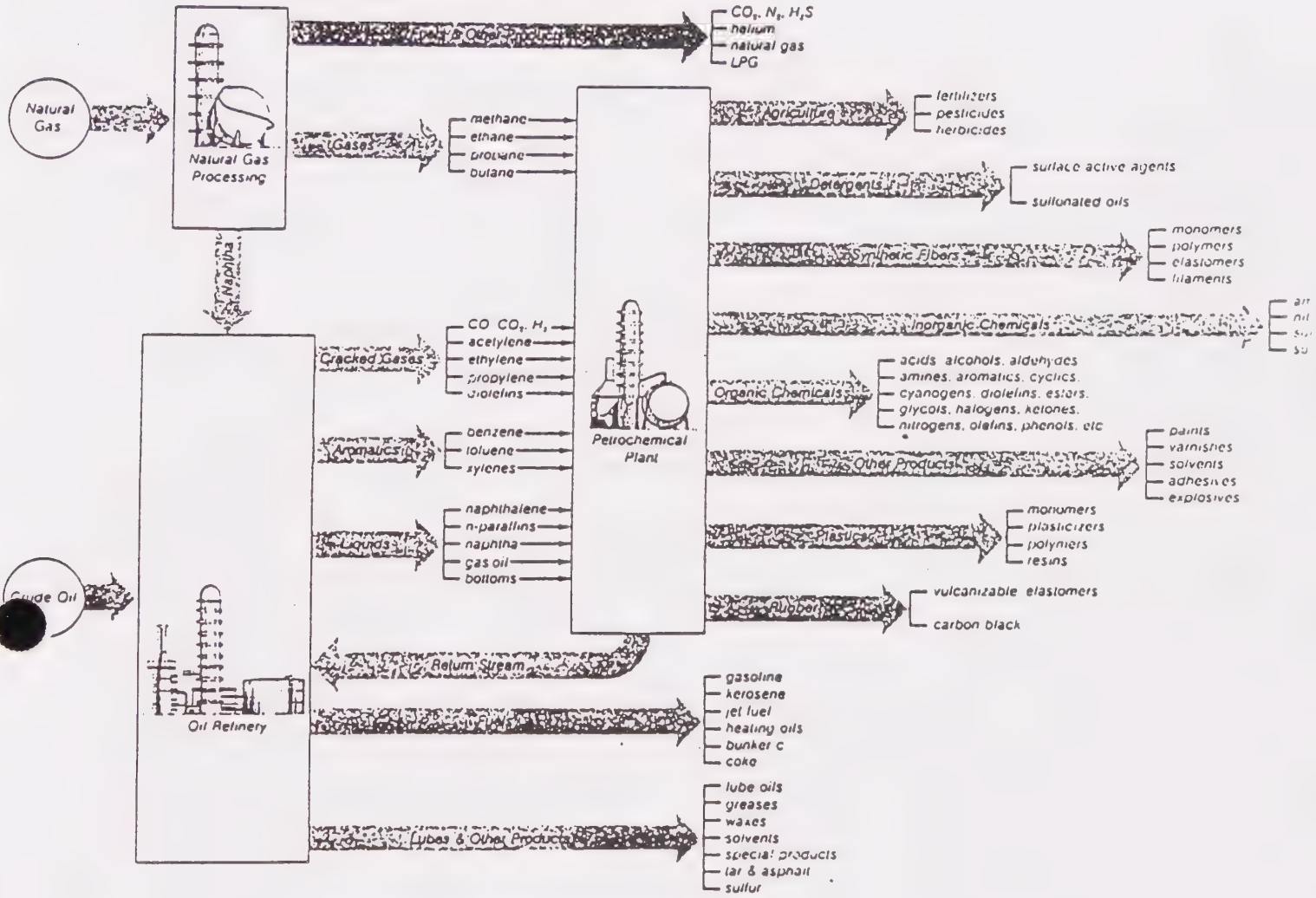
Based on information we now have, it seems clear that the epoch of readily available supplies of oil and natural gas will probably be over in the world around 2015 to 2030 and in the United States around 2010. Since it takes 20 to 50 years to develop and phase in a new energy system, we have no time to lose in seeking replacements.

Natural gas and especially oil exploration in the United States and the world was stimulated by a rapid rise in price during the 1973-74 energy policy crises. If these explorations are successful, we may have an oil glut for a few years (Macrae 1974). Regardless of how real the 1973-74 energy situation was or whether the present energy glut is contrived, we must not lose sight of the real severe shortages that seem destined to occur within a few decades. We cannot delay the institution of a massive energy conservation program and a crash program to develop alternate energy sources.

Instead of getting all of our fossil fuels out of the ground as quickly as possible, a very strong case can be made for deliberately setting aside perhaps a third of our reserves of natural gas and petroleum as raw material to produce petrochemicals in future decades. These chemicals are used to produce most of the fertilizers, pesticides, detergents, synthetic fibers, inorganic and organic chemicals, plastics, and other products in modern society (Figure 4). A look at Figure 4 also reveals why the price of antifreeze, plastics, clothes, paint, tires, and many other products of an industrialized nation rises a few months after a shortage or price increase in crude oil or natural gas.

The use of petrochemicals is growing rapidly and already accounts for about 6% of all fossil fuels used in the United States. It seems unlikely that an entirely new chemical industry (one not based on fossil fuel raw materials) could be developed in the next few decades. As a result, this may be the single most important use of these resources. On the other hand, since petrochemicals are inherently incompatible with the environment, we should deliberately shift from the widespread use of petrochemicals to more natural chemicals and products.

Figure 4. The Petrochemicals Industry



II. Current Status/Analysis

A. Sources of Data/Analysis

A variety of sources have been utilized for the preparation of this report. Primary sources were publications and personnel of the California Energy Commission, Southern California Edison, and Southern California Gas Company. The Section I. Introduction is from a college textbook, "Energy and Environment: Four Energy Crises" by G. Tyler Miller, Jr.. For a complete list of references refer to the Bibliography in the Energy/Telecommunications Background Report, on file with the Office of Planning.

B. Scope of Existing Conditions/Trends

1. The United States

The United States is the most intensive consumer of energy resources in the world. With approximately 6% of the world's population we consume about one-third of the total energy consumed worldwide. Americans rely predominately on fossil fuels which comprise 68% of the total United States energy sources. The remaining 32% energy sources come from a variety of resources such as nuclear, hydroelectric, solar, geothermal, and biomass.

The United States presently imports 40% of its petroleum from foreign countries. This percentage is projected to increase to 50% in the next five to ten years with profound implications on the country's trade and budget deficits. By developing energy efficient technologies and conservation programs we can improve our energy self-sufficiency and economic conditions. Not only is energy self-sufficiency good for our national economy but it is good for the security of our country. By reducing our consumption of petroleum products we will maintain a larger domestic reserve of resources for the long term and improve the overall environmental quality of the country. The development of clean renewable energy resources is currently possible with existing technologies and the technologies are improving rapidly.

Increasing United States and worldwide oil demand will allow the Organization of Petroleum Exporting Countries (OPEC) to regain control of oil prices. Thus, despite current ample oil supplies and low prices, our vulnerability to future oil price increases and supply disruptions is increasing. Therefore, there is great need for improvements to the rate of energy consumption primarily in the transportation sector which comprises three-quarters of total oil and gas consumption. Local government will play a key role in implementing transportation improvements. These include proposals to determine suitable land use patterns, traffic engineering measures, and other measures under local governmental control. During the 1984 Olympics in Los Angeles, air emissions were lowered as the level of traffic was reduced 10 percent due to a shift to higher occupancy vehicles, an adoption of flexible work schedules, increased use of mass transit, and a willingness of truck drivers to avoid expected areas of congestion.

The effect congestion is likely to have on urban transportation is an important factor in determining future energy demands for transportation. Congestion alters energy consumption patterns by causing vehicles to operate at less than optimum efficiencies. For example, fuel economy will decrease up to 50 percent in stop-and-go congestion conditions. In southern California, the average speed at which vehicles travel over the regions' 1,500 miles of freeways during peak periods is 47 mph. Caltrans' forecasts show that unless relief measures are quickly implemented, the present transportation system's level of service could decline rapidly. Transportation energy demand will continue to increase as a consequence of this accelerating congestion problem.

Globally, the production of carbon dioxide from fossil fuels burning is causing rapid changes to the atmosphere with severe implications to climate, agriculture, forests, and ecosystems.

According to the U.S. National Academy of Sciences, the **greenhouse effect** will raise global temperatures by as much as nine degrees fahrenheit over the next 50-100 years. Carbon dioxide released from burning fossil fuels (coal, oil & gas) and the leveling of forests, acts to trap solar heat in the atmosphere. The level of carbon dioxide in the air has doubled since the beginning of the Industrial Revolution.

Rapid global warming will raise sea levels as oceans expand and polar ice melts, destroy 50-80% of our wetlands, abruptly alter weather and rainfall patterns, and severely disrupt agriculture. Coastal regions will be flooded, today's grain belts could turn to dust bowls, forests will die, and countless species will be extinguished.

Reducing emissions of carbon dioxide is the single most important measure we can take to arrest climatic change. The United States should lead the way by committing ourselves to a national energy plan that will reduce our use of fossil fuels by 50% by 2015. San Bernardino County should do its share and reduce its per capita fossil fuels consumption by 50% by 2015 as well. Legislation is necessary to reduce reliance on fossil fuels through greater energy efficiency and increased use of renewable resources. Our nation could save up to 50 billion **barrels** of oil by the year 2015 by using existing technology to build efficient automobiles and to heat and cool our buildings with less energy.

Electricity-saving devices widely installed in homes and businesses could shut down more than 200 coal power plants and would reduce carbon dioxide emissions from utilities by one third. A comprehensive energy efficiency plan could save America one and a half trillion dollars by 2015 (Adams, 1988).

2. Transportation

All facets of the economic structure are interconnected by important modes of transportation. Therefore, **conservation** of energy in transportation will bring about significant changes to life and will dramatically shape future environments.

The major factor contributing to the enormous growth in transportation fuel consumption is attributable to the tastes, habits, and aspirations of the American public. Foremost among those is an almost total disregard of any problem posed by the rate of energy consumption. As a consequence, Americans tend to ignore the trade-offs between fuel consumption and speed, convenience, safety, and comfort of transportation. Therefore, the trend toward more powerful, larger cars and more cars per family has been persistent. The average car gets about 15 to 20 mpg and is generally used by only one person.

If large savings in energy are to occur over the long term, activities of many federal agencies such as the Department of Housing and Urban Development (HUD) and the Environmental Protection Agency (EPA) must be coordinated with those of the Department of Transportation (DOT). Since, no single step is likely to have an appreciable effect by itself, a comprehensive program must be enacted which acts on the many opportunities for energy conservation. The County should actively pursue coordination with these agencies, and the respective state agencies, to develop and finance comprehensive energy conservation programs.

The most significant realizable measures to effect conservation are:

a) improved insulation in homes,

b) adoption of more efficient air-conditioning systems,

c) shift inter-city freight from highway to rail; inter-city passengers from air to ground travel; urban passengers from automobiles to mass transit; and freight consolidation in urban freight movement,

d) introduction of more efficient industrial processes.

Over the long-term, technology and urban design stand out as the areas of greatest promise in reducing the rate of growth of transportation energy demand. Transportation acts as the most effective single form-determining element of the man-made environment. A very large scale commitment to rail and bus transit systems, and extensive bikeways, rather than the perpetuation and expansion of the automobile-roadway systems, will prove more appropriate in long range sociological and environmental terms, as well as functional terms. The factors such as population distributions, economic structures, land-use policies, and public attitudes, as well as transportation policies, must be changed concurrently if we are to produce significant environmental changes.

As an influence on the urban scene, possibly the only factor that can compare with the automobile is population growth itself. We are facing a land use crisis, and if present trends continue, in the next 22 years the U.S. population will increase by some 45 million more people in a landscape more shaped to fit the needs of the automobile than the needs of humanity. Probably 80 to 85% of these people will be living in urban places by the year 2000.

Development of urban clusters can minimize the need for transportation and allow open space preservation needed for ecosystems and contact with,and understanding of, nature, so necessary in these days of ever increasing technological systems. Energy efficiency can be greatly increased by providing a combination of incentives to separate people from automobiles -- rapid transit trunk lines between clusters and attractive walkways, moving walkways, bicycle paths, rest and refreshment areas within clusters. Appropriate coordination in transportation and urban planning can yield enormous dividends not limited just to energy conservation but including benefits such as improved environment, health, economic condition and the mobility of people.

In 1972, an exhaustive study conducted by the Real Estate Research Corporation for The Council of Environmental Quality, The Department of Housing and Urban Development, and The Environmental Protection Agency, concluded (in 1972 dollars) that:

1) Total capital costs for the high-density planned community are 56% of those for the conventional low-density sprawl development, resulting in a cost savings of $227.5 million for communities with 10,000 housing units.

2) For single items included in the above capital cost, the savings for high-density versus low-density development amount to ($12,725,000) for land, ($15,103,000) for streets, and ($39,542,000) for utilities.

3) Operating and maintenance costs in the high-density planned community are estimated to be approximately $2 million (11%) less per year than the low-density sprawl.

4) Compared to low-density sprawl, the amount of total capital costs borne by local governments may decrease by almost 50%. Operating and maintenance costs borne by local government may decrease by 13%.

5) Total air and water pollution and other forms of environmental degradation are similarly reduced. Air pollutants from automobiles are reduced 50%, and those from space heating and other natural gas uses are reduced 40%. Sediment is reduced 30% and total storm water run-off 20%.

6) Energy consumption is reduced 44% and water consumption 35% in high-density planned communities.

This means that, if the low-density sprawl continues, the price of urban development will be nearly double what it would cost in almost every category noted above when compared with the cost of high density planned development.

At 95% efficiency, the bicycle is by far the most energy efficient mode of transportation known which can allow for much conservation for the majority of all trips from the home (less than 5 miles). Bicycle trips fall into four principal categories: Commuting to

work, commuting to school, shopping, and recreation. Encouraging the use of bicycles for these short but frequent trips will greatly reduce energy demands.

As indicated in Tables 1 and 2, cars are clearly the most energy demanding mode of all the land based modes: subways are about 5 times more efficient, trains are 6 times, and a local bus is 3 1/2 times more efficient than an automobile. The express bus is the most efficient mode, consuming only one-eighth the energy of an automobile with a moderate passenger load. The difference between local and express bus operation is due to the higher occupancy in express service, combined with the fact that less energy is lost from frequent stops and starts. Likewise, the energy efficiency of rail systems is affected by acceleration rates, braking systems and frequency of station stops.

Efficiency of rail and subway cars have been adversely affected by declining ridership. Increasing mass transit ridership will decrease the per passenger energy requirements.

The major factors which affect energy consumption are:

1) Vehicle weight - True for all transportation systems, but particularly crucial for the automobile. A 5,000 lb. car takes twice as much fuel to run than a 2,500 lb. car.

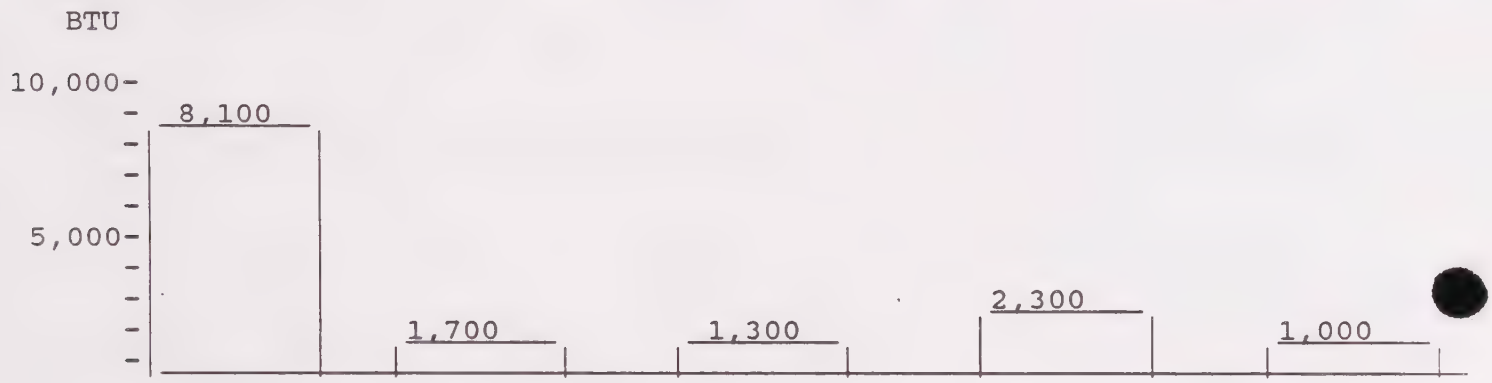
2) Vehicle Speed - At the high and low end of the spectrum, vehicle speeds are more energy demanding than in the range from 20-45 mph. Thus freeway speeds 55-70 mph as well as urban stop and go driving greatly increase the autos appetite for fuel.

3) Frequency of trips -- Transportation demands are greatly affected by the degree of clustered urban activities and by density.

Fifty-five percent of the automobile miles traveled each day occur on urban streets where congestion causes fuel consumption to greatly exceed 55 percent of the total. In fact, urban automobile usage is growing more than twice as fast as rural. When thousands of people are going the same way at the same time, as it happens during the rush hours, it is needlessly expensive to move by auto. To put it in terms of crude oil consumption, the amount expended to carry one individual in the average commuting car could carry at <u>least</u> 10 persons the same distance in a bus or rail car.

Greater density offers the further advantage of open space preservation. Cities with sprawl development, such as Los Angeles, require and utilize 40% of the urban area for roads and parking. Construction of a comprehensive mass transit system could reduce the amount of land area needed for roads about 50%.

Table 1. Energy Demands of Passenger Transportation Modes



mode:	Auto	New subway	Commercial rail	Local bus	Express bus
speed:	67 mph	30 mph	40 mph	15 mph	50 mph
occupancy:	25%	50%	50%	30%	58%

Source: Shonka, D.B., 1977

Table 2. Energy Efficiency of Various Passenger Transport Systems in the United States

Transport Type	Passenger Miles/U.S. Gal. (130,000 BTU)
Helicopter	7.5
Large Automobile (1)	8.0
U.S. Supersonic Transport Airplane	10.0
B-707, DC-8 Jet Airplane	20.0
Most Autos (2)	30.9
Small Autos (2)	60.0
Small Autos (4)	100.0
Suburban Bus	250.0
Two-Level Electric Train	300.0
Microbus (7)	350.0
Broad Gauge Train	375.0
Bicycle (3 mph)	1000.0
(5 1/2 mph)	858.0
(13 mph)	645.0
Walking (2 1/2 mph)	390.0
(3 mph)	409.0

* Single numbers in parentheses = # occupants

Source: Shonka, D.B., 1977, modified by Osborne, Neal E., 1978

3. San Bernardino County

San Bernardino County adopted the Joint Utilities Management Program (JUMP) in 1976 to plan for energy conservation, production, and facilities siting. Land use compatibility and environmental constraints prompted the development of siting criteria to guide the review of proposed facilities. For the protection of natural resources in the County which may potentially contain energy sources, it may be necessary to provide open space for the preservation of these natural resources. The possible need for siting of energy plants, transmission lines, or telecommunications relay stations may require the provision of open space for public health and safety. These facilities may be utilized for emergency situations and the stable functioning of society. Open space preservation may also be necessary for aesthetics, wildlife management, and wise efficient land use. The Siting Criteria Checklist and the Siting Analysis Maps were prepared to summarize the primary issues of energy facilities siting. The Siting Criteria Checklist is included in the Background Report on file in the Office of Planning and the Siting Analysis Maps are adopted by reference into this report.

a. Primary Fuel Supplies

San Bernardino County has very limited fossil fuel resources. Small amounts of oil and natural gas are produced from wells located in the Chino Hills area. These quantities represent an insignificant portion of the total California production (Table 3). No refineries are located in San Bernardino County. Pipelines are located in San Bernardino County through which large quantities of natural gas, gasoline, and oil are transported to and from southern California, both from California and other portions of the United States (Table 4). Due to these limited supplies, San Bernardino County must import the majority of its fossil fuel supplies. Consequently, the sources of San Bernardino County's fuel supply are essentially the same as that for all of southern California.

Significant geothermal, uranium, oil and gas or other energy georesource deposits have not been discovered in the county, although potential resources do exist (See Figures 5, 6, 7, 8).

Table 3. San Bernardino County Oil and Gas Production 1987

OIL FIELD	OIL (BBL)	NET GAS WITHDRAWN (MCF)	WATER(BBL)
Chino-Soquel	1,800	0	270
Mahala	43,900	3,200	108,000
County Total	45,700	3,200	108,270
California	366,000,000	217,000,000	2,580,000,000

BBL= Barrels or 42 gallons Mcf= Million Cubic Feet

Source: California Department of Conservation, Division of Oil and Gas. "1987 California Oil and Gas Production Statistics and New Well Operation", Preliminary Report issued January 1988, p.4.

Table 4. Utility and Pipeline Companies with Facilities in the County

A. Oil or Gas Pipelines

Four Corners Pipeline Company
Cal Nev Pipeline Co.
Pacific Gas & Electric Co.
Southern California Gas Co.
Southern Pacific Pipelines Inc.
BAS Pipelines
Fontana Pipeline Inc.
All American Pipeline Co.

B. Utility Companies

Southern California Edison
Southern California Gas Co.
Los Angeles Department of Water and Power
Southwest Gas Company
Southern California Water and Electric
City of Colton Electric Utility

C. Telecommunications Companies

ATT
GTE
US Sprint
MCI
Pacific Bell
Continental Telephone

Figure 5. Economic Mineral Resources

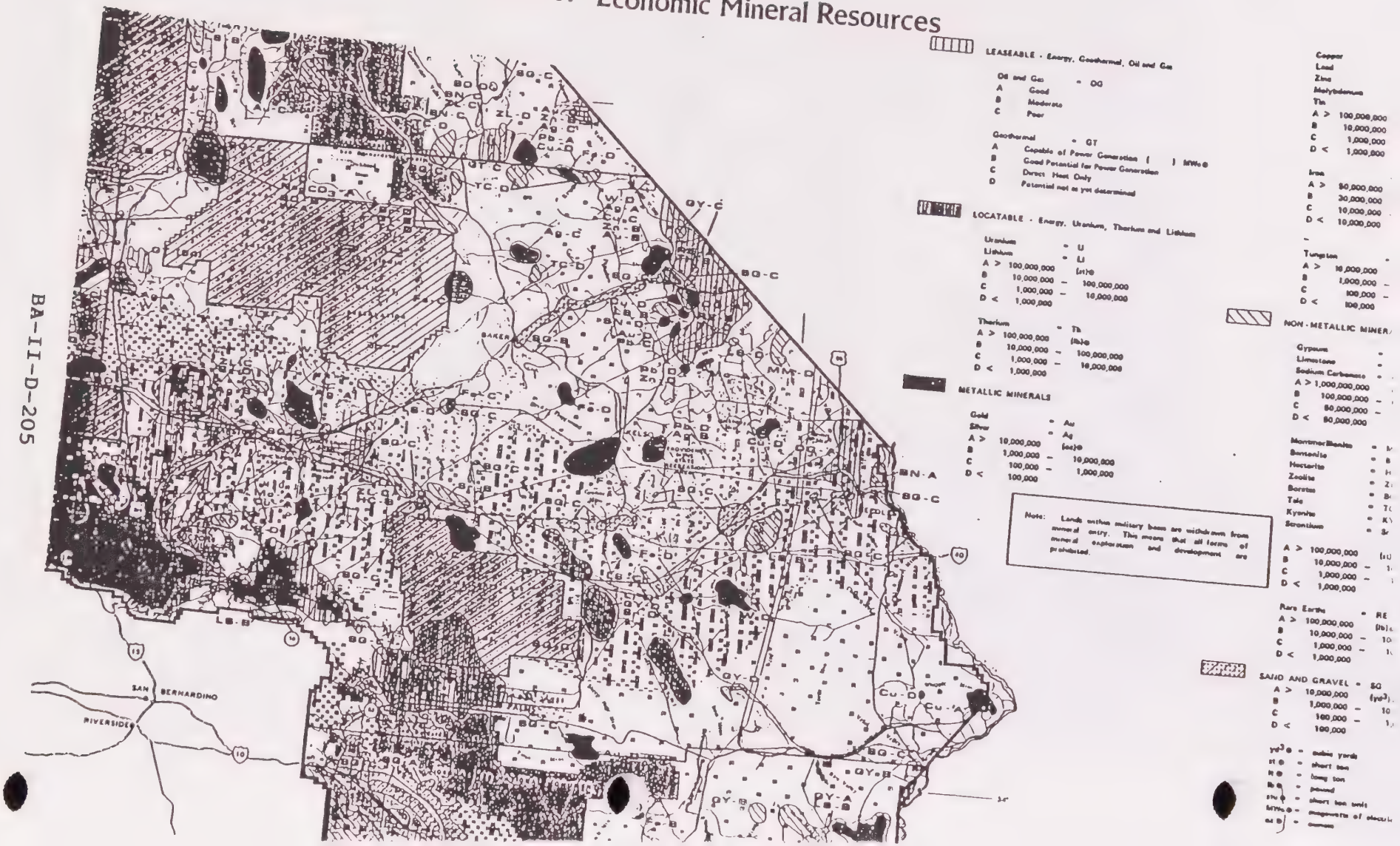
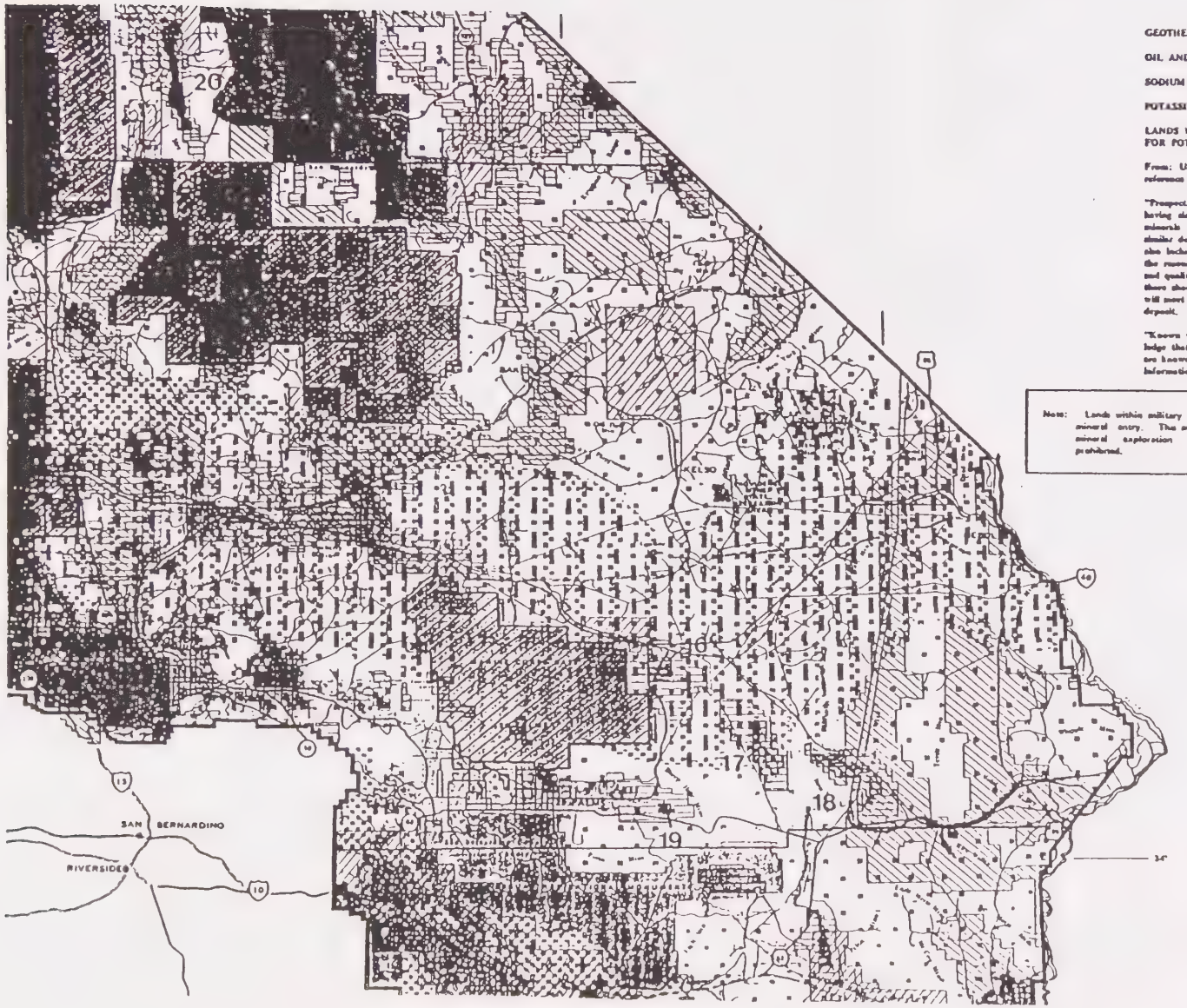
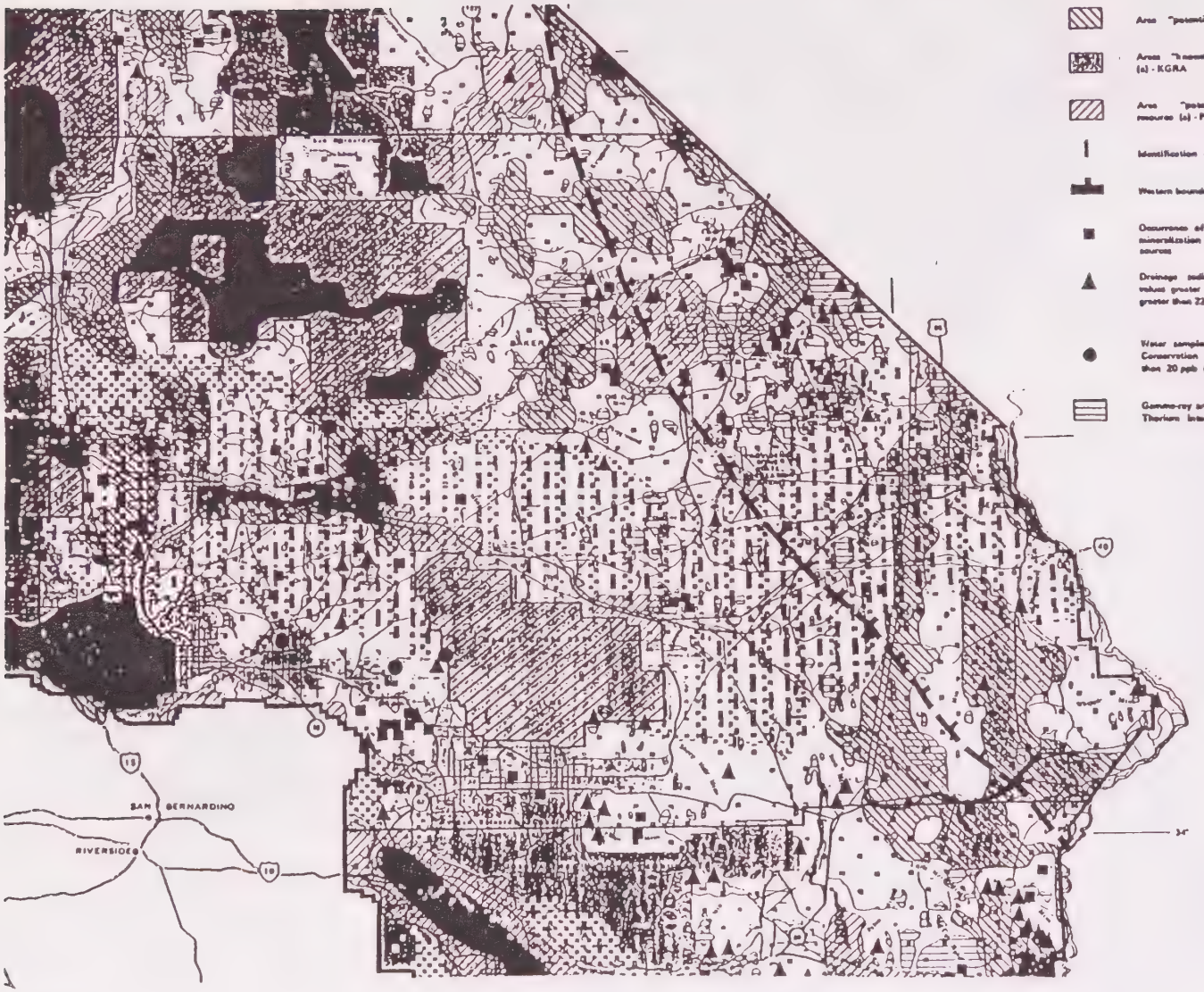


Figure 6. **Potential For Leaseable Minerals**



Source: California Desert Conservation Area Plan, U.S. Department of Interior, Bureau of Land Management, 1980, Map 13, p.109

Figure 7. Potential For Energy Georesources



Area "potentially valuable" for Oil and Gas (a)(b)

Area "known valuable" for Geothermal resource (a) - KGRA

Area "potentially valuable" for Geothermal resource (a) - PGRA

Identification number of KGRA (see list below)

Western boundary of Overthrust Belt (c)

Occurrence of Uranium (U) and/or Thorium (Th) mineralization from 12 published and unpublished sources

Drainage sediment geochemical sample with U values greater than 320 ppm (d) and/or Th values greater than 220 ppm

Water samples from test holes drilled by USGS Conservation Division with U_3O_8 values greater than 20 ppb (e)

Gamma-ray anomalous (f) area for Uranium and/or Thorium interpreted from airborne survey data

KNOWN GEOTHERMAL RESOURCE AREAS

1- Salton Valley
2- Coso
3- Randsburg
4- Ford Dry Lake
5- Salton Sea
6- Brawley
7- Glamis
8- East Mesa
9- Dunes
10- Niland

(a): These areas were adapted from the USGS Conservation Division classification as per Administrative Report. "Leasable Mineral Resources of the California Desert Conservation" - January, 1979. Definitions of "known valuable" and "potentially valuable" are given in the same report, as well as in G.E.M. Resources Appendix, and in the Legend of the Leasables Minerals Map.

(b): There are no areas identified as "known valuable" for Oil and Gas (fossil fuel).

(c): Overthrust Belt: the Overthrust Belt is a tectonic continental geologic structure extending from Canada to Mexico. It is a broad zone of generally similar geology and shallow-angle faults along which rocks on the west side were thrust over those on the east, thus forming geologic environments favorable for the formation and entrapment of oil and gas. It is better understood in its northern part (Idaho, Wyoming, Utah) where exploration efforts resulted in oil and gas discoveries. Its southern extension (Nevada, California, Arizona) is not yet well defined and its potential not well understood. For these reasons, the boundary shown on the map is very general.

(d): ppm=parts per million; that is, one gram in one metric ton

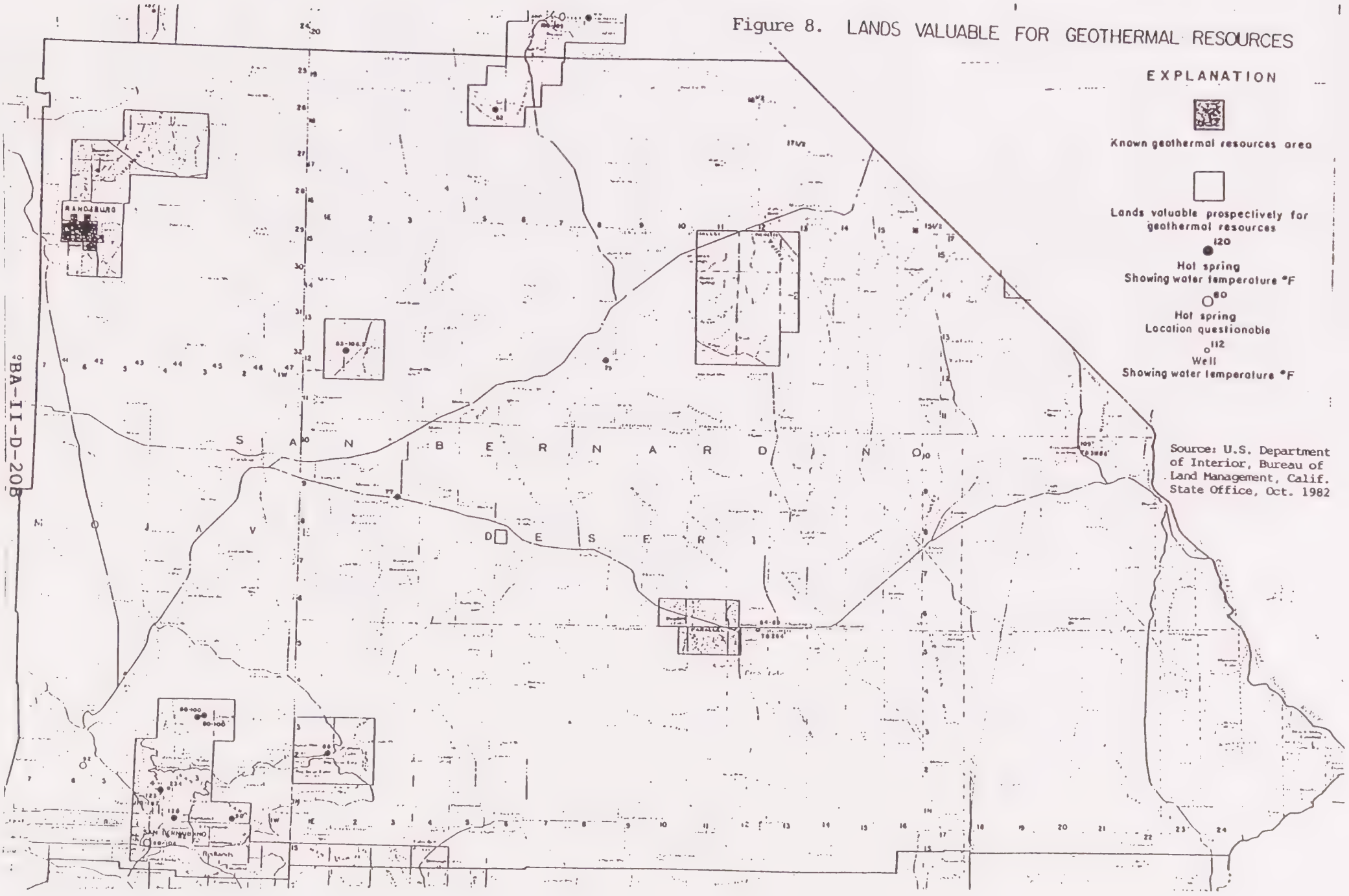
(e): ppb=parts per billion; that is, one gram in 1000 metric tons

(f): Anomalous= a minimum of two adjacent data points each with two or more standard deviations above the mean.

Note: Lands within military bases are withdrawn from mineral entry. This means that all forms of mineral exploration and development are prohibited.

Source: California Desert Conservation Area Plan, U.S. Department of Interior, Bureau of Land Management, 1980, Map 15, p.113

Figure 8. LANDS VALUABLE FOR GEOTHERMAL RESOURCES



San Bernardino County residents, businesses, and industries have natural gas and electricity service provided by five primary utilities. These utilities are:

1) Southern California Gas Company
2) Southwest Gas Corporation
3) Southern California Edison Company
4) Southern California Water and Electric Company
5) City of Colton Municipal Utility.

The Southern California Gas Company provides natural gas service to the valley areas, the Morongo Basin, and portions of the mountain area of the County. The Southwest Gas Corporation provides natural gas service to Victor Valley, Barstow, other portions of the north desert area, and the Bear Valley communities (See Figure 9).

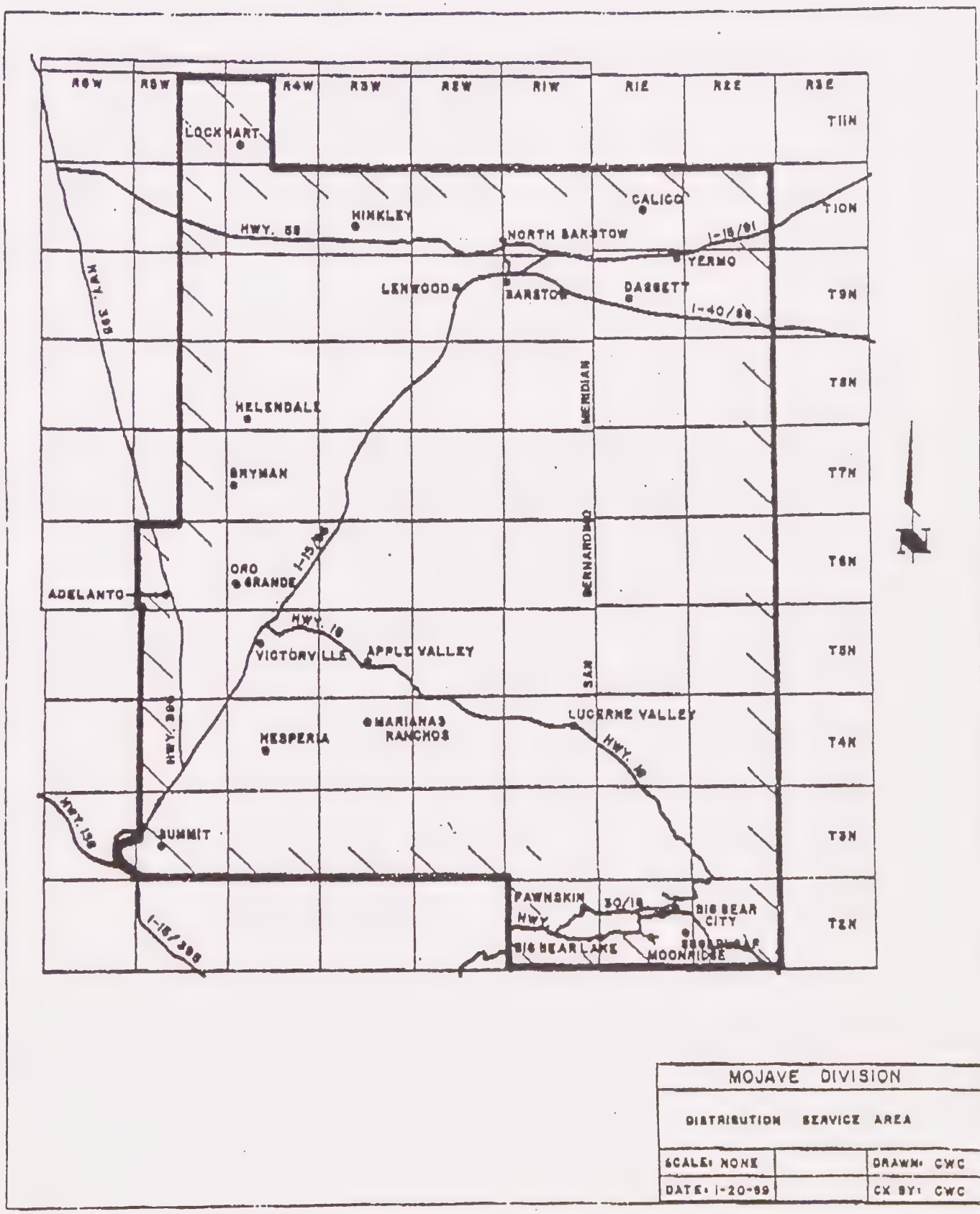
The natural gas demand in the County for 1988 is estimated at 45,012 million cubic feet (See Table 5). By the year 2010, natural gas demand is estimated to increase 73.7% to 78,186 million cubic feet. At the SCAG buildout estimate with a population of 4,528,300, the natural gas demand is estimated at 164,294 million cubic feet.

The estimated liquid fuels demand in the County for 1988 is 303,140,000 gallons (See Table 6). The estimated propane demand in the County for 1988 is 10,675,800 gallons (See Table 7).

b. Electricity in San Bernardino County

San Bernardino County is within the service area of the Southern California Edison Company (SCE) which is part of the Pacific **Intertie** system. This means that electricity generated throughout the ten western states could be sent to the County as needed or electricity generated in the County could be used anywhere throughout the system. Other electric utilities include Southern California Water and Electric which serves the Bear Valley communities and buys its electricity from SCE, and the City of Colton Municipal Utility (which buys its electricity from various sources)(See Table 8). The County electricity transmission network and energy production and utility corridors are shown in Figures 10 & 11. SCE operates eleven thermal (oil or gas fired) generating stations in the County, and fifteen small hydroelectric plants on

Figure 9. Southwest Gas Corporation Service Area



MOJAVE DIVISION		
DISTRIBUTION SERVICE AREA		
SCALE: NONE		DRAWN: CWC
DATE: 1-20-99		CK BY: CWC

Table 5. San Bernardino County Natural Gas Demand 1988

Demand Sector	Utility Companies Demand in mmcf	
	Southwest Gas Corp.	So. Cal.Gas Co.
Residential	3,465	19,000
Commercial	1,121	10,500
Industrial	1,420	9,000
Military	441	
Gas Engines	65	
Subtotal	6,512	38,500

Grand Total = 45,012 mmcf (million cubic feet)

Sources: a) Southwest Gas Corporation, John Goodman, March 13, 1989, Personal Communication
b) Southern California Gas Company, John Archibald, March 13, 1989, Personal Communication

Table 6. San Bernardino County Estimated Liquid Fuels Demand 1988

Fuel Type	Gallons
Gasoline	36,270,000
Gasohol	21,800,000
Diesel	75,800,000
Aviation Fuel	1,970,000
Military Jet	29,040,000
Common Carrier Jet	116,360,000
Bunker C Fuel Oil	21,900,000
Total	303,140,000

Source: Schuler, Bob; California Board of Equalization, Personal Communication and Extrapolation from statewide data, March 22, 1989

Table 7. San Bernardino County Estimated Propane Demand 1988

Distributor	Demand in Gallons
Petrolane	4,242,800
Proflame	800,000
Cal Gas	750,000
Suburban	750,000
Ferrell Gas	4,133,000
Grand total =	10,675,800

Table 8. San Bernardino County Electricity Demand 1988

Demand Sector	Electric Utilities Demand in kwh		
	City of Colton	S.C.Water & Electric Big Bear Communities	SCE*
Residential	65,875,976	45,899,124	3,267,377,463
Agriculture Class			215,064,166
Commercial	74,081,263	29,468,861	2,846,816,070
Industrial	31,990,710	9,876,614	1,793,869,578
Public Authority-- Street Lights		304,440	946,905,090
Water Pumping -- Interdepartmental		2,825,975	
Subtotal	171,947,949	88,375,014	9,070,032,367

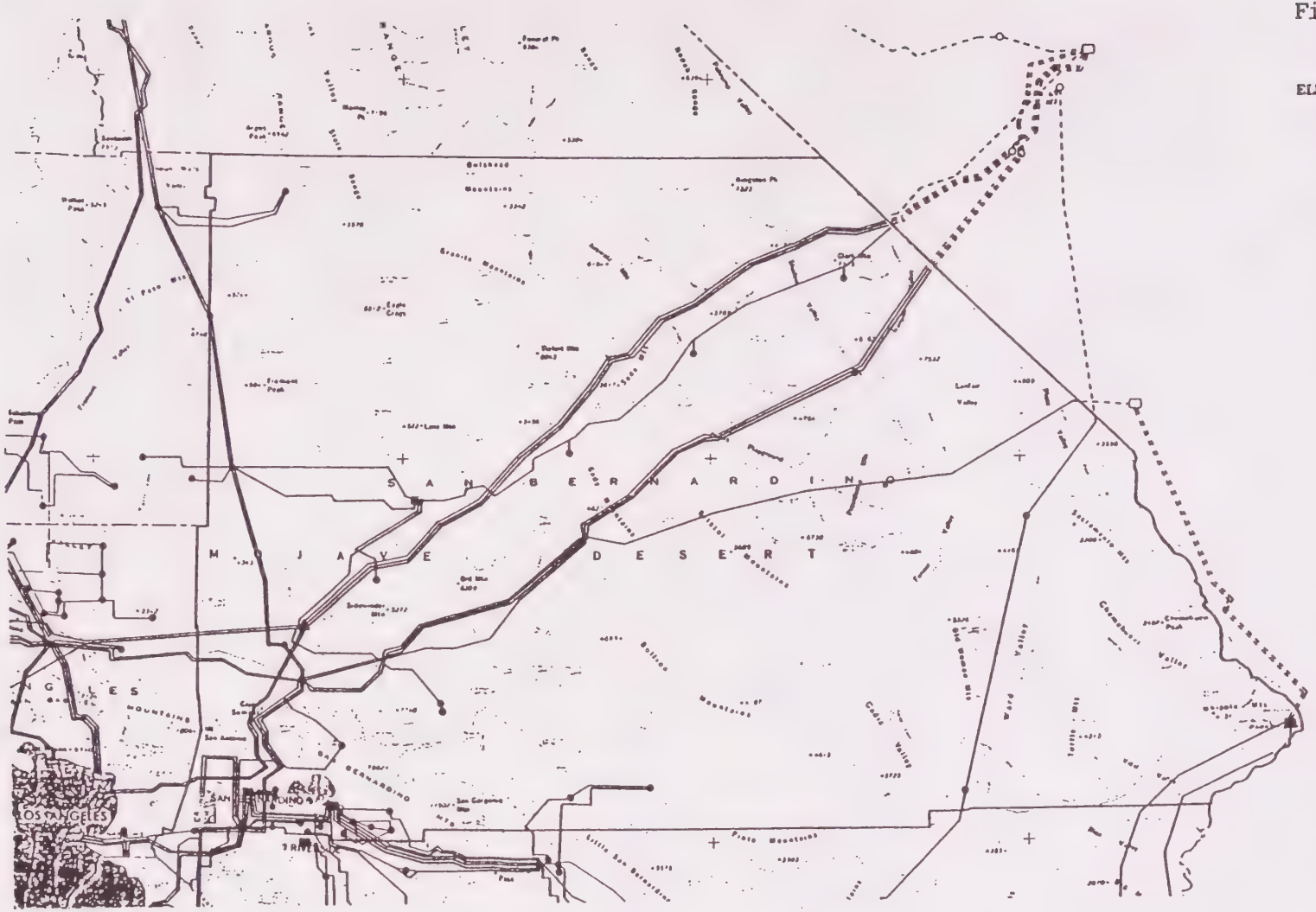
Grand Total = 9,330,355,330 kwh
= 9,330 Gwh

* SCE area includes Corona and Norco in Riverside County. Assume demand from these cities is 230 Gwh. Therefore San Bernardino County estimated demand is 9100 Gwh.

Sources:
a) City of Colton, Robert Buell, March 8, 1989, Correspondence
b) Southern California Water and Electric, John Redding, March 14, 1989, Personal Communication
c) Southern California Edison, Sue Noreen, March 15, 1989, Personal Communication

Figure 10.

ELECTRICITY TRANSMISSION NETWORK



■ POWERPLANT • SUBSTATION ▲ METER STATION

60 - 100 KV OVER 100 KV

10 0 10 20 30 40 50 60 70 80 Miles

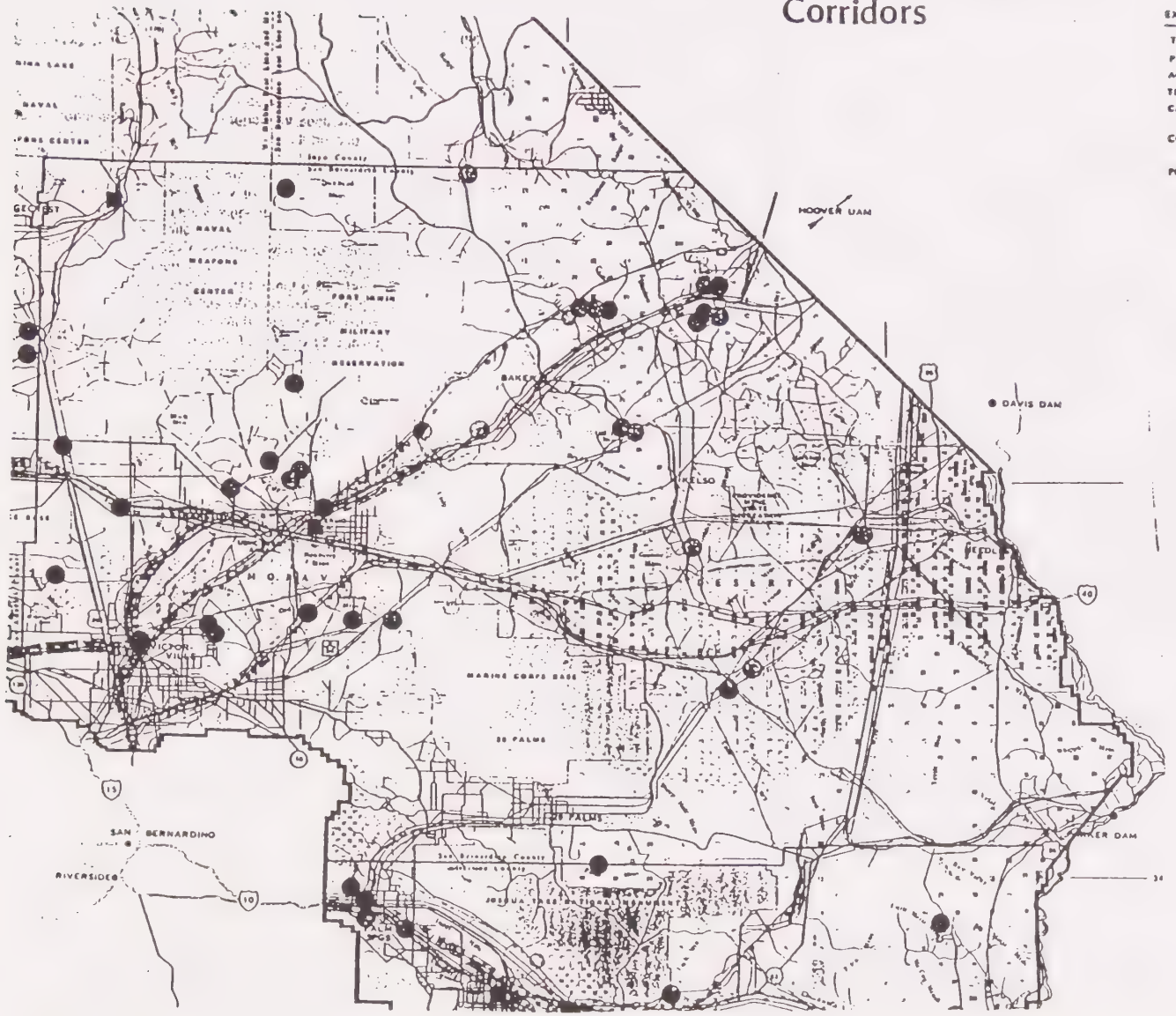
10 0 10 20 30 40 50 60 70 80 90 100 Kilometers

TRANSMISSION NETWORK

Compiled and prepared at California State University, Northridge in the summer/fall of 1981. Cartography by Paul A. LeGrand and Darryl K. Whitney under the supervision of Professor Arnold Court.

Source: Wind Atlas, California Energy Commission and Department of Water Resources, April 1985

Figure 11. Energy Production & Utility Corridors



Source: California Desert Conservation Area Plan, U.S. Department of Interior, Bureau of Land Management, 1980, Map 16, p.117

the south sides of the San Bernardino and San Gabriel Mountains.

Table 9 shows the 1986 capacities of the operational, under construction, and proposed power generating stations in San Bernardino County. Approximately 45 percent of the generating capacity in the County is represented by the Etiwanda plant. About 10.5 percent of total SCE system generating capacity is in the County. Etiwanda is one of the larger plants in the SCE system. Hydroelectric capacity plays a relatively small role in the total generating capacity within the County, representing less than 6 percent of total capacity. The estimated electricity demand for the County in 1988 was 9100 Gwh. By the year 2010, the demand is estimated to increase by 98.3% to 18,045 Gwh. At the SCAG buildout estimate for the County, with a population of 4,528,300, the demand is estimated to increase 353% over 1988 demand to 41,223 Gwh.

c. Energy Sources

Energy sources are natural resources available within the county which can be utilized to perform work. Examples of work accomplished from energy use are lighting, heating, cooling, cooking, transportation, communication, and mechanical actions for industrial and manufacturing processes.

The energy resources within the county are solar radiation, wind, hydropower, oil, gas, biomass, **cogeneration**, lithium and uranium.

Oil and gas resources exist in the county in limited quantities. Two oil fields, Chino-Soquel and Mahala, in the Chino Hills and Prado Basin areas respectively, produced the only oil and gas in the County as reported in the California Department of Conservation, Division of Oil and Gas reports for 1986 and 1987. In 1986, 40 wells in these two oil field areas produced 43,343 barrels of oil and 2,746 million cubic feet of natural gas. In 1987, the production was 45,700 barrels of oil and 3,200 million cubic feet of natural gas. These production quantities represent less than one tenth of one percent of California's total production. The quantity of oil and gas reserves of these oil fields was presented in the 1986 and 1987 reports as being undetermined.

Table 9.
SAN BERNARDINO COUNTY POWER PLANTS (OPERATIONAL-UNDER CONSTRUCTION-PROPOSED) 1986

MAP	POWER PLANT TYPE		LOCATION	CAPACITY (MW)	SERVICE AREA
MAP-1	OIL/GAS-OPERATIONAL				
	Map #				
	36.1	Cool water 1-4	Daggett	628.00	SCE
	36.2	Etiwanda 1-5	Etiwanda	1028.00	SCE
	36.3	Big 3 Industries (Cogen)	Etiwanda	.70	SCE/QF
	36.4	Highgrove 1-4	Highgrove	154.00	SCE/QF
	36.5	San Bernardino 1 & 2	Norton AFB	126.00	SCE
	36.6	Chino Muni Water Dist(Cogen)	Chino	.40	SCE/QF
	36.7	Fontana High School (Cogen)	Fontana	.08	SCE/QF
	36.8	Inland Container Corp(Cogen)	Ontario	36.00	SCE/QF
	36.9	Intl. Power Tech (Cogen)	Ontario	12.10	SCE/QF
	36.10	Chaffey Comm. College(Cogen)	Rcho Cucamonga	.08	SCE/QF
	36.11	Alta Loma High School(Cogen)	Alta Loma	.08	SCE/QF
	36.12	Kerr-McGee Chem Corp (Cogen)	Westend	17.00	SCE/QF
	36.13	Loma Linda Univ (Cogen)	Loma Linda	2.40	SCE/QF
	36.14	Victor Valley Hospital(Cogen)	Victorville	.14	SCE/QF
	36.15	Gas Turbine-Waste Heat(Cogen)	Trona	15.00	SCE/QF
	OIL/GAS-UNDER CONSTRUCTION				
	36.16	San Antonio Comm Hosp(Cogen)	Ontario	.08	SCE/QF
	OIL/GAS-PROPOSED				
	36.17	Upland High School (Cogen)	Upland	.08	SCE/QF
	36.18	Corona Energy Corp (Cogen)	Ontario	42.00	SCE/QF
	36.19	Ontario Cogen Inc. (Cogen)	Ontario	5.50	SCE/QF
	36.20	YMCA (Cogen)	San Bern.	.06	SCE/QF
	36.21	OLS-Chino (Cogen)	Chino	27.75	SCE/QF
	COAL-OPERATIONAL				
	36.23	Calif Portland Cement (Cogen)	Colton	25.00	SCE/QF
	36.24	Riverside Cement Co (Cogen)	Victorville	17.00	SCE/QF
	COAL-PROPOSED				
	36.25	Biogen Power Plant	Ivanpah	14.00	SCE/QF
MAP-2	BIOMASS-OPERATIONAL				
	36.1	O.K. Power	Chino	2.00	SCE/QF
	BIOMASS-PROPOSED				
	36.2	American Diversified	Ontario	30.00	SCE/QF
	36.3	Biogen Power Corp.	Barstow	17.10	SCE/QF
	36.4	Valley Power Corp.	Barstow	49.90	SCE/QF
	36.5	Marmac	Victorville	45.00	SCE/QF

Table 9.
SAN BERNARDINO COUNTY POWER PLANTS (OPERATIONAL-UNDER CONSTRUCTION-PROPOSED) 1986
(Continued)

MAP	POWER PLANT TYPE		LOCATION	CAPACITY (MW)	SERVICE AREA
MAP-2	WASTE TO ENERGY-OPERATIONAL				
	MAP #				
	36.6	Central Plants Inc.	Upland	.50	SCE/QF
	WASTE TO ENERGY-PROPOSED				
	36.7	Energy Tech Association	San Bern.	40.90	SCE/QF
	36.8	P.L.E.S. Cajon Pass	San Bern.	1.00	SCE/QF
	36.9	P.L.E.S. Fontana	San Bern.	1.50	SCE/QF
	36.10	P.L.E.S.	Redlands	5.00	SCE/QF
	36.11	P.L.E.S. Yucaipa	Redlands	.50	SCE/QF
	36.12	P.L.E.S. Milliken	Ontario	5.00	SCE/QF
	36.13	P.L.E.S. Colton	Colton	1.50	SCE/QF
	36.14	Rialto Power Corp	Fontana	35.00	SCE/QF
MAP-4	WIND-OPERATIONAL				
	36.1	Recreational Lake	Newberry Springs	.03	SCE/QF
	SOLAR-OPERATIONAL				
	36.2	Westside Comm. Corp	San Bern.	.04	SCE/QF
	36.3	Industrial	San Bern.	.04	SCE/QF
	36.4	Solar Kinetics Inc.	Barstow	48.00	SCE/QF
	36.5	Solar Energy Gen. Sta. I	Daggett Lake	13.80	SCE/QF
	36.6	Solar Energy Gen. Sta. II	Daggett Lake	30.00	SCE/QF
	36.7	Arco Solar Electric Power Inc.	Hesperia	1.00	SCE/QF
	SOLAR-UNDER CONSTRUCTION				
	36.8	Renewable Power Corp	Yermo	15.00	SCE/QF
	36.9	Solar Energy Gen. Sta. III	Daggett	30.00	SCE/QF
	SOLAR-PROPOSED				
	36.10	Ornat Turbine Ltd.	Danby Dry Lake	48.00	
	36.11	Solar Energy Gen. Sta. IV	Daggett	120.00	
	36.12	Solar Kinetics	Barstow	14.00	
MAP-5	OPERATING HYDROELECTRIC				
	36.1	San Bdno Municipal	San Bern.	.85	SCE/QF
	36.2	City of Upland	Upland	.67	SCE/QF
	36.3	Cucamonga CWD	Cucamonga	.02	SCE/QF
	36.4	Devil Canyon 1 & 2	San Bern.	120.00	DWR
	36.5	Fontana #1 & #2	Rialto	2.36	SCE
	36.6	Lytle Creek #1, #2	Rialto	.40	SCE
	36.7	Mill Creek #1,2,3	Mentone	2.80	SCE
	36.8	Santa Ana #1,2,3	Santa Ana River	5.20	SCE

Source: California Energy Commission, June 1986, "Local Agency Siting and Permit Assistance Program: California Power Plant Maps".

Other potential oil and gas reserves may prospectively exist in other parts of the County as indicated on the BLM Oil and Gas Map of southern California. The 1980 California Desert Conservation Area Plan (CDCA) reports that no oil nor gas production occurred within the CDCA boundaries and no areas have been identified as "known valuable". However, there is some potential for oil and gas resources as mapped on the CDCA Energy Georesources Map. The oil and gas potential of the CDCA falls in two categories:

1) association with marine Miocene age sedimentary rocks of the Antelope and Imperial Valleys; and
2) Paleozoic age association with the "Overthrust Belt".

The "Overthrust Belt" extends through the eastern part of the County where active exploratory drilling has occurred in the Ivanpah Valley and possibly in the Mid Hills area. Actual potential for production of oil and gas in the "Overthrust Belt" is speculation at this time since the area has not been fully explored and evaluated.

The hydropower resources in the County are currently harnessed by fifteen hydroelectric facilities located on the south sides of the San Bernardino and San Gabriel Mountains. These facilities are: San Bernardino Municipal, City of Upland, Cucamonga CWD, Devil Canyon 1 & 2, Fontana 1 & 2, Lytle Creek 1 & 2, Mill Creek 1, 2, & 3, and Santa Ana 1,2, & 3. These facilities represent less than six percent of the total 1986 electric generating capacity in the County (132.3 **Megawatts** out of a total 2289.66 MW). These facilities already harness the limited number of streams in the County and it is unlikely that future hydroelectric development could occur at a significant level. However, there may be some additional hydroelectric potential in future water, wastewater, or flood control projects such as the Seven Oaks Dam on the Upper Santa Ana River. Feasibility studies need to be prepared to analyze the net energy potential of future hydroelectric developments. Environmental studies will also need to be prepared to analyze and mitigate impacts to the riparian and aquatic ecosystems.

The climatic conditions prevalent in the county limit annual precipitation below a level for year-

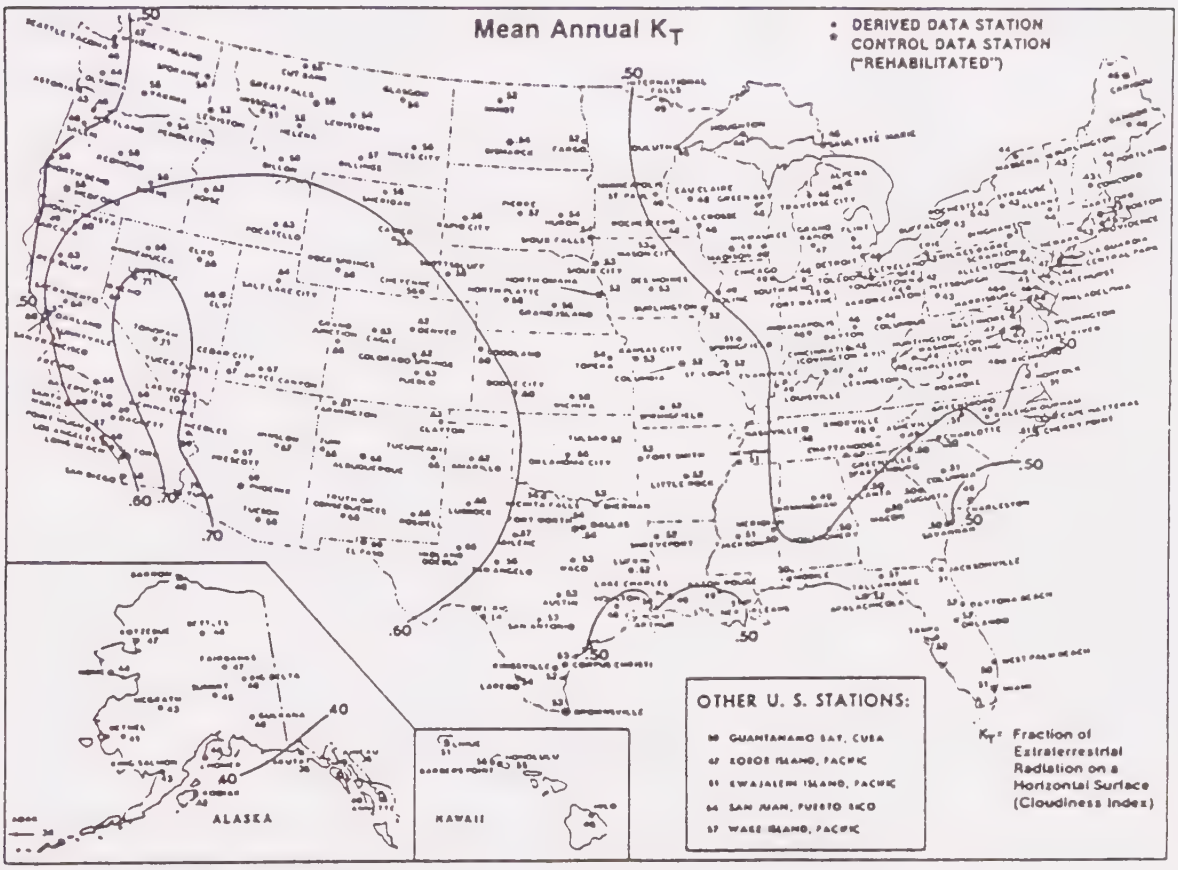
round streams in most areas except in the mountains. Therefore, the valley and desert areas are unlikely sites for hydroelectric facilities. The total hydroelectric capacity will be reduced by diminished streamflows caused by drought conditions and possibly by groundwater withdrawals.

The County is served primarily by Southern California Edison (SCE) for electricity. In 1986, hydroelectric facilities provided 21% of the total electricity generated within the entire SCE planning area. In addition, SCE receives hydro-generated electricity through the Pacific Intertie system. There are numerous hydroelectric facilities which supply the Pacific Intertie system throughout the ten western states. The largest capacity facilities are Bonneville Dam on the Columbia River and Hoover Dam on the Colorado River. The generating capacity of all hydroelectric facilities are adversely impacted by drought conditions.

The major significant energy resources the County appears to have are solar and solid waste energy. The greatest potential source of energy is solar energy. The applications of solar energy include space and water heating, cooling, and generation of electricity. Presently, the traditional energy sources can usually produce heat or power at less total cost than the capital costs plus maintenance of a solar energy system. However, with significantly increasing costs and demands for traditional fuels, solar energy is becoming more cost competitive. This trend is expected to continue. Solar energy development may have adverse environmental impacts but the impacts are primarily dependent on the technology used, the scale of the development, and its location (See Appendix A-2 in the Background Report on file with the Office of Planning for a discussion of the Luz Engineering Corporation's proposed solar plants near Harper Lake).

The estimated annual incident solar energy in San Bernardino County is equivalent to 5.9×10^{10} barrels of oil (JUMP 1976). The County receives some of the highest solar **insolation** values in the United States as shown in Figure 12. Insolation values within the County will vary by site specific environmental conditions, but as an example, the solar energy measured at the Cal-Tech Solar Observatory at Big Bear Lake is 696,000 BTU per year (Table 10). Solar insolation values recorded

Figure 12. Solar Insolation Map of the United States



SOURCE: SOLAR ENERGY RESEARCH INSTITUTE

in Inyokern, Riverside, and Las Vegas can be used as representative values for the desert and valley areas (Table 11).

Assuming a 1988 population of 1,250,000 for the County, and that each individual generates 3.4 pounds of waste per day, (the energy potential of solid waste is 6000 BTU/lb and one barrel of oil has 6,000,000 BTU), the annual energy potential of solid waste generated in San Bernardino County is equivalent to 1,500,000 barrels of oil (modified from JUMP, 1976). The transfer of energy in solid waste to a usable form will be difficult. Incineration facilities emit air pollutants and have ash residues which need to be landfilled. However, bioconversion of solid waste may be an environmentally superior alternative which could

Table 10. Solar Insolation in Bear Valley

Month	1,000s of BTU
January	36
February	43
March	61
April	70
May	81
June	80
July	79
August	71
September	61
October	49
November	35
December	30
Total	696

Source: Ruddick, Steve. 1988. "Bear Valley Communities Plan Initial Study", San Bernardino County Office of Planning, p.76.

create methane gas and liquid methanol, both relatively clean burning fuels.

Conservation can also be considered an energy source by achieving the same level of work but more efficiently and economically-- reducing the demand for energy. By choosing the appropriate energy source mix and effective conservation measures, an improved quality of life and environment will result.

The County imports 90% of the energy consumed from adjacent counties, states, and foreign countries. This report attempts to show how important energy use and production are to land use management, economics, and lifestyles within the County. The Bush administration projects a federal budget deficit of 163 billion dollars for fiscal year 1989 and 91 billion dollars for fiscal year 1990. This problem can be reduced by improving our trade imbalance due to oil imports by the local production of renewable energy resources. Energy self-reliance will create jobs and help keep money within the local economy. Another very important benefit from renewable energy development and conservation is protection of the ecosystem. The greenhouse effect has been of great concern in

Table 11. Insolation Values (in Kwh/m^2) for Inyokern, Riverside, and Las Vegas

Location: Reno, NV Latitude: 39° 30'

	TILT ANGLE		
MONTH	LATITUDE -15°	LATITUDE	LATITUDE +15°
J	4.3	4.9	5.2
F	5.4	5.8	6.0
M	6.5	6.7	6.5
A	7.6	7.3	6.7
M	7.8	7.2	6.2
J	8.0	7.2	6.1
J	8.0	7.3	6.4
A	7.8	7.5	6.9
S	7.1	7.4	7.1
O	6.1	6.7	6.9
N	4.8	5.5	5.9
D	3.8	4.5	4.8

Location: Inyokern, CA Latitude: 35° 40'

	TILT ANGLE		
MONTH	LATITUDE -15°	LATITUDE	LATITUDE +15°
J	5.3	6.2	6.6
F	6.7	7.3	7.5
M	8.2	8.4	8.2
A	8.8	8.5	7.8
M	9.1	8.3	7.2
J	9.3	8.4	7.1
J	8.8	8.1	7.0
A	8.9	8.6	7.8
S	8.4	8.7	8.4
O	7.0	7.7	8.0
N	5.9	6.8	7.3
D	5.1	6.1	6.6

Location: Riverside, CA Latitude: 33° 60'

	TILT ANGLE		
MONTH	LATITUDE -15°	LATITUDE	LATITUDE +15°
J	4.3	4.9	5.3
F	5.5	5.9	6.0
M	6.5	6.7	6.5
A	6.6	6.4	5.9
M	7.2	6.6	5.8
J	7.6	6.9	5.9
J	7.6	7.0	6.1
A	7.3	7.1	6.5
S	6.8	7.0	6.7
O	5.7	6.2	6.3
N	4.8	5.5	5.9
D	4.3	5.0	5.4

Source: Hall, Michael et al., July 1982

recent months and a shift away from fossil fuels to **renewables** will help reduce the amount of carbon dioxide released. Air pollution such as carbon monoxide, nitrogen oxides, sulfur oxides, particulates, and ozone could be reduced significantly. Acid precipitation which damages trees, vegetation, soils, and water quality would also be reduced by a shift away from fossil fuels to renewables. In general, the overall quality of life for man and ecosystems will benefit from sensible choices of energy production, use, and conservation.

Glossary

Barrel: In the petroleum industry, a barrel is 42 U.S. gallons. One barrel of oil has an energy content of 6 million British Thermal Units. It takes one barrel of oil to make enough gasoline to drive 700 miles at 18 miles per gallon.

Bioconversion: Processes that use plants or micro-organisms to change one form of energy into another.

Biomass: Energy resources derived from organic matter. These include wood, agricultural waste and other living-cell material that may be burned to produce heat energy. They also include algae, sewage and other organic substances that may be used to make energy through chemical processes.

British Thermal Unit (BTU): The standard measure of heat energy. It takes one BTU to raise the temperature of one pound of water by one degree Fahrenheit at sea level. It takes about 2,000 BTUs to make a pot of coffee.

Capacity: (Electric Utility) The maximum amount of electricity that generating unit, power plant or utility can produce under specified conditions.

Celsius (C): A temperature scale based on the freezing (O degrees) and boiling (100 degrees) points of water. Abbreviated as C.

Cogeneration: The sequential generation of electrical energy and low-grade heat from the same fuel.

Conservation: Steps taken to cause less energy to be used than would otherwise be the case. These steps may involve improved efficiency, avoidance of waste, reduced consumption, etc.

Electricity: A property of the basic particles of matter. A form of energy having magnetic, radiant, and chemical effects.

Energy: The capability of doing work. The resources that make a technology operational.

Fossil Fuel: Oil, coal, or natural gas. Fuel that was formed in the earth in prehistoric times from remains of living-cell organisms.

Greenhouse effect: Gradual warming of global climates due to buildup of carbon dioxide in the earth's atmosphere.

Insolation: Amount of solar radiation.

Intertie: A transmission line that links two or more regional

electric power systems.

Megawatt (MW): One thousand kilowatts or one million watts.

Renewable Energy: Resources that constantly renew themselves or that are regarded as practically inexhaustible. These include solar, wind, geothermal, hydro and wood.

Therm: One hundred thousand BTU.

Watt: A unit of measure of electrical power at a point in time.

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HOUSING/DEMOGRAPHICS

HOUSING/DEMOGRAPHICS

All substantiating data is located in the complete Housing Element (under separate cover). It is also an adopted part of the General Plan Update.

LAND USE/GROWTH MANAGEMENT

LAND USE/GROWTH MANAGEMENT

I INTRODUCTION

San Bernardino County, with a land area of over 20,000 square miles, is the largest county in the continental United States. The County comprises three distinct geographic regions; the Valley, the Mountain and the Desert. With an estimated population of 1.24 million in January 1988, and an annual growth rate of approximately 5%, it is projected that the population of the County could be 2.2 million by the year 2010. The additional people and their attending needs for services will place additional demands on both the natural and man-made resources in the County. The inadequacy of existing infrastructure facilities to meet projected demands for services, and the imbalance between jobs and housing are two of the most crucial land use issues that require immediate attention.

DEFINITION

The Land Use Element is both a graphic and textual description of the official county policy on the proposed location and distribution of land uses within the county. State law recommends that the Land Use Element should address each of the following issues to the extent that it is relevant:

- Distribution of housing, business, and industry;
- Distribution of open space, including agricultural lands;
- Distribution of mineral resources and provisions for their continued availability;
- Distribution of recreation facilities and opportunities;
- Location of education facilities;
- Location of public buildings and grounds;
- Location of future solid and liquid waste facilities;
- Identification of areas subject to flooding, and,
- Identification of existing Timberland Preserve Zone (TPZ) lands. (There is no TPZ land in San Bernardino County.)

Also, the Land Use Element shall include a statement of the standards of population density and building intensity recommended for the various districts and other territory covered by the plan. Traditionally, population density and building intensity have been expressed in terms of the number of dwelling units per acre but in the landmark case of Twain Harte Homeowners Association v. Toulumne County (1982) 138 Cal. App. 3d 664, population density was defined in more specific terms as the numbers of people in a given area. This can be obtained by multiplying the number of dwellings per acre by the number of residents per dwelling. The court further found that... "it would not be unreasonable to interpret the term population density as relating not only to

residential density, but also to uses of non- residential land categories and as requiring an analysis of use patterns for all categories."

The Twain Harte court further recommends that building intensity should be defined for each of the various land use categories in a plan. Building intensity is not the same as population density; its computation is a function of a combination of variables- maximum dwelling units per acre, height and size limitations, and use restrictions. Floor Area Ratio (FAR) (the ratio of building floor area to the total site area) is a useful measure of commercial and industrial intensity, while the dual standard of maximum lot coverage and maximum building height is suitable for agricultural, open space, and recreational designations where development is being limited.

II SCOPE OF EXISTING CONDITIONS/TRENDS

A. POPULATION

The estimated population of the unincorporated portion of the County in January 1988 was 428,667. This was an increase of 104,486 (28.53%) over the 1981 population of 324,181. (See Table 1 which lists the population of the unincorporated portion of the County from 1981 to 1988.) The average annual population growth ranges from a low of 2.55 percent between 1982 and 1983 to a high of 5.14 percent between 1986 and 1987. The State's average annual growth rate during the same time period was less than two percent (2%). Between 1986 and 1987, the unincorporated portion of the County added 20,046 new residents. This is almost 20 percent of the total population increase in the unincorporated area in the last eight years, and this trend is expected to continue according to SCAG's population projection.

It is estimated that the population of the unincorporated portion of the County will be 977,470 in the year 2010. This does not account for new incorporations or annexations. This an increase of 548,803 over the 1987 figures, translating into an average annual absolute increase of 24,946 or an annual growth rate of 5.8 percent. From 1981 to 1987, the unincorporated area of the County contained an average of thirty five percent (35%) of the total county population. This same area is expected to absorb 44.36 percent of the total County population which is predicted to be 2.2 million (SCAG estimates) by the year 2010. (See Table 2.) The predicted population growth will result in the conversion of significant amounts of vacant land currently devoted to agricultural production and other non urban uses to residential, commercial and industrial development. Additional demands that will be placed on local infrastructure facilities (water, sewer etc.) may over-burden the existing facilities. Traffic congestion

TABLE 1

UNINCORPORATED
COUNTY POPULATION 1981-1988

YEAR (a)	POPULATION	POPULATION INCREASE	ANNUAL GROWTH RATE	% OF TOTAL INCREASE	CUMULATIVE % INCREASE
1981	324,181				
1982	340,819	16,638	5.13	15.92	15.92
1983	349,518	8,699	2.55	8.33	24.25
1984	361,994	12,476	3.57	11.94	36.19
1985	376,064	14,070	3.89	13.47	49.66
1986	390,241	14,177	3.77	13.57	63.23
1987	410,287	20,046	5.14	19.18	82.41
1988	428,667 (b)	18,380	4.48	17.59	100.00
Total		104,486	28.53	100.00	100.00
88-2010	977,470	548,803	5.81 (c)		

Note:

(a) As of January of each year indicated.

(b) This figure includes the population of the three newly incorporated cities of Highland, Twentynine Palms and Hesperia and Apple Valley whose populations are estimated to be 29,000, 11,700, 55,000 and 50,000 respectively.

(c) Draft projections by SCAG.

Source: County of San Bernardino, Office of Planning.

TABLE 2

SHARE OF TOTAL COUNTY POPULATION ABSORBED BY THE UNINCORPORATED AREAS ONLY.

	1981	1982	1983	1984	1985	1986	1987	2010
Unincorporated	324,181	340,819	349,518	361,994	376,064	390,241	410,287	977,470
Total County	920,409	955,563	984,549	1,1016,996	1,062,713	1,109,294	1,167,175	2,205,046
Percent	35.22	35.67	35.56	35.59	35.38	35.17	35.15	44.36

Source: San Bernardino County Office of Planning

is predicted to increase significantly in and around economic activity locations, and along work commute travel paths exacerbating the air pollution problems and the demand for non-renewable energy resources.

Some of the Land Use measures that can be employed to mitigate some of the negative impacts associated with future development include the following:

1. Mixed Land Uses/Multiple Use Development
2. Infill development
3. Decentralization
4. Cluster development
5. Growth control/management
6. Land Use Exactions (development fees)
7. Linkage Strategies/Job Housing balance
8. Urban Design/Performance Standards
9. Transfer of Development Rights (TDR)
10. Others e.g. Telecommunication, Flow equalization basins, water reuse, etc.

Table 3 is a matrix that matches each land use strategy with the impact area that can be mitigated by the strategy. Table 3 illustrates that each land use strategy has the potential to influence a host of impact areas. All of the Land Use strategies listed here can be employed to different degrees by the County to produce the desired effects.

1. Mixed Land Uses/Multiple Use Development

This alternative encourages the mixing of land uses with the intent of bringing housing closer to employment and shopping opportunities. It entails the mixing of uses within the same building and residences above strip commercial development. Traditional Euclidean Zoning System which seeks to separate land uses, or create spatial separations between them is not designed to accommodate mixed use development. The County may accommodate some mixed uses by designating certain areas, and Planned Development and by encouraging cottage industries (PD). Mixed use development reduces the demand for natural as well as man-made resources and maximizes utilization of available services.

TABLE 3
POSSIBLE MITIGATION MEASURES

1. Mixed Land Uses/Multiple Use Development
2. Infill development
3. Decentralization
4. Cluster development
5. Growth control/management
6. Land Use Exactions (development fees)
7. Linkage Strategies/Job Housing balance
8. Urban Design/Performance Standards
9. Transfer of Development Rights (TDR)
10. Others e.g. Telecommunication, Flow equalization basins, water reuse, etc.

Impact Area	1	2	3	4	5	6	7	8	9	10
Air Quality	X		X	X	X		X	X	X	
Energy	X	X	X	X	X		X	X		
Ecological Resources	X	X	X	X				X	X	
Seismic Hazard			X					X	X	
Open Space	X	X	X	X	X			X	X	
Agriculture	X	X	X	X	X			X	X	
Land	X	X	X	X	X			X	X	
Transportation	X	X	X	X	X	X	X	X	X	X
Water Supply	X	X	X	X	X	X	X	X	X	X
Wastewater Treatment	X	X	X	X	X	X	X	X	X	X
Hazardous Waste								X	X	
Schools	X	X	X	X	X				X	
Fire Protection	X	X	X	X	X	X		X	X	
Police Protection	X	X	X	X	X	X		X	X	
Economy/Employment	X	X	X	X	X	X	X	X	X	X
Housing	X	X	X	X	X	X	X	X	X	X
Health Services	X	X	X	X		X				
Social Services	X	X	X	X		X				
Criminal Justice								X		
Governances								X		
Neighborhood/ Community								X		

2. Infill Development

This strategy encourages development on vacant skipped-over parcels of land in otherwise built-up areas. This measure can be a very effective tool for accommodating additional growth, without adding or expanding infrastructure, to the extent that excess roadway capacity, water and sewer facilities exist in urban infill areas. It also spreads the costs of routine maintenance and replacement of aging facilities among a larger number of users. Infill development strategy is not appropriate where the available infrastructure is already at capacity; additional development will overburden the system. Infilling may be accomplished through various use incentives/disincentives including: varying development fees, land use designations and Infrastructure financing and expansion policies.

In addition to infrastructure considerations, there are other factors that need to be considered when determining whether or not to employ this strategy; these factors include whether the land has high open space benefits if left vacant or whether it has any physical constraints that may make developing it impossible or excessively expensive. One potential barrier to infill-development (from the developers standpoint) is the possibility that higher land prices in infill areas could offset the capital costs incurred in building or expanding new infrastructure in less developed areas.

3. Decentralization

The concept of decentralization is discussed here in terms of a regional or macro urban form. This concept would direct greater amounts of future expected regional growth to outlying, less developed areas, while directing lesser amounts of growth to highly urbanized areas. Decentralization does not mean that <u>all</u> growth would be directed to outlying areas; growth would still occur in urbanized areas. Although this urban form would ultimately require expansion of existing and/or construction of new infrastructure facilities, the cost could be less due to lower land costs. The objective of decentralization is to establish several self-sustained, balanced communities.

4. Cluster Development

On a micro or local level, this measure involves increased flexibility in subdivision and zoning regulations, allowing for new residential development to occur in a clustered form instead of the conventional grid pattern, and also for greater multifamily dwelling unit development. Many studies by the development community have shown that costs of housing and on-site improvements can be lowered substantially by reducing lot sizes and clustering homes, without raising overall density or doing away with single family dwelling units. Clustering reduces the total length of

residential streets required, and deeper setbacks also minimize the need for on-street parking and wide streets. Although residential streets are increasingly paid for by developers, direct benefits can be derived by local government, in terms of reduced street maintenance costs.

Also, the County may cluster commercial developments into larger nodes thereby reducing the number of access from major highways.

5. Growth Control/Management

These measures include longer term planning controls that regulate the rate, location and amount of new development vis-a-vis the availability of adequate infrastructure (e.g., growth phasing plans and adequate public facilities ordinances. These measures are most appropriate in areas where rapid development outpaces the ability to provide necessary infrastructure. They are instituted to manage future growth/development. The measures generally do not reduce the cost of infrastructure, but they do allow local government to regulate development until adequate facilities can be provided. In some cases, infrastructure costs can actually be saved when government controls direct development to areas within a jurisdiction where adequate facilities already exist (i.e., adequate public facilities ordinances), or to contiguous areas where facilities can be provided more cheaply than when development occurs in a "leap-frog" fashion.

Because the County was concerned about its future growth, a Growth Management Task Force was established on April 4, 1988 to develop a plan with schedule to implement the proposed short and long term action items for growth management which are approved by the Board of Supervisors. Ten short term (within 6 months) actions that are being considered include strategies to transfer the cost of future demand for infrastructures facilities and public services from the County to developers, builders and users. Also, these action items underscore optimum utilization of existing facilities by encouraging infilling of existing urban areas, and annexation of sphere of influence areas to adjacent incorporated cities which can more readily provide needed public services.

Long term action items being considered further emphasize the County's commitment to link future land development to the existing or planned capital improvement. Four of the five actions being considered are directed towards the establishment of infrastructure development fees and/or special taxes. The fifth action is a public education campaign which is expected to familiarize the general public with actions adopted and implemented by the Board of Supervisors. Both the short and long term action items are designed to enhance, or at least preserve the perceived quality of life of current county residents; the assumption being that additional population increase has the potential to strain

the existing infrastructure facilities thereby depreciating the quality of life of current as well as future residents.

All these actions are designed to manage future growth. The County's position is that some growth is inevitable and may even be desirable. However, since some existing infrastructure facilities cannot support and sustain the predicted population increase, and the current tax payers are not expected to bear the fiscal responsibility of future growth, developers, builders and users may have to pay a share of the cost of providing needed infrastructure facilities and public services. The idea of variable regional development fees, and providing incentives for commercial and industrial development are attempts to distribute the fiscal burden of future growth in an equitable and progressive manner. Other General Plan Systems being developed, including the Master Environmental Assessment (MEA), Development Monitoring and Forecasting (DMF) and Infrastructure Monitoring and Reporting System (IMRS), are all designed to provide the data that will be used to estimate appropriate development fees for specific areas. Also, requiring fiscal impact and infrastructure financing reports for all new large development, makes it easy to allocate a fair share of projected cost to the developer of a specific proposed development.

6. Land Use Exactions (Development Fees)

A number of measures are available to local governments to shift the cost of providing infrastructure required by growth from the public sector and community-at-large to the private sector. Some of these measures are summarized below:

- Special assessments - can be levied on properties to collect revenue needed to finance public improvements that directly benefit the properties and that are necessitated by its development.

- Exactions - are imposed by government as a condition of development approval, and take the form of land and facilities, or fees. They can be used for on-site improvements, such as roads, sidewalks, streets, street lighting, and traffic signals, and sometimes off-site improvements if fees are provided in lieu of land or facilities.

- Impact taxes and fees - provide local governments with greater latitude than exactions because fees may be used to pay for off-site projects such as intersection improvements, new streets, transit services, and interchanges. These taxes and fees benefit not only the developments assessed, but the surrounding community as well. Taxes and fees are usually based on a fixed charge per residential unit.

- o Development agreements - allow local governments to negotiate agreements with private developers, specifying on and off-site improvements to be made by the developer.

Generally these measures shift the costs of providing infrastructure from the public to the private sector. They are being used by an increasing number of jurisdictions, especially since passage of Proposition 13. The County may have to institute some of these measures to provide services that will be required for future development.

7. Linkage Strategies/Job/Housing Balance

This strategy involves promoting a better balance between the number of jobs and housing within the County. One basic technique to achieve a balance is to attract greater economic development activities to the County. Also, developers of homes may be required to pay a special development fee to help attract jobs to the County. This linkage strategy has been executed in Santa Monica, San Francisco and Boston where developers of commercial and office developments have to pay special fees to help develop needed housing in the mentioned areas. Since the County is "housing rich and job poor", the County may adopt policies granting incentives to developments that will create new jobs. This may include the creation of special enterprise zones/districts and the provision of needed infrastructure facilities to encourage the location of industries and other businesses in these areas.

8. Urban Design/Performance Standards

This strategy involves establishing criteria and standards for designating land use districts, and for determining the intensity of land use types. The inherent flexibility of these systems equip them to prescribe smaller residential streets where and when appropriate, and to encourage alternative transportation systems such as pedestrian walkways and bicycle paths. Building orientation and location of access points may reduce demand for energy as well as incidents of crime. The County should consider policies that will promote better utilization of all its resources.

9. Transfer of Development Rights (TDR)

This strategy is designed to preserve large open spaces especially in areas that have physical or natural constraints. Development is concentrated in the buildable area to the maximum density allowed by the District. The County should adopt policies to retain areas from where density has been transferred as permanent open space.

10. Other

There are a host of other measures that can be employed to mitigate some of the negative impacts associated with development. These measures include "Telecommunication" which may have an indirect effect on the demand for land and other natural resources, and infrastructure (especially transportation) facilities. Telecommunication in the context of this report refers to a sophisticated electronic technology for the exchange of information via computers, word processors, television and telephone. Advances in telecommunication make it easier to transport information directly without transporting the messenger as well. This technology (system and equipment for telecommunication) already exists and is currently being used in many organizations including San Bernardino County.

B. LAND INVENTORY

1. **Land Ownership/Jurisdictional Control**

San Bernardino County encompasses an area of 20,164 square miles (12,904,960 acres) of which approximately seventy five percent (75%) is controlled by public agencies. (Table 4 shows ownership pattern and jurisdictional control of all County land. Also, see Figures 1a and 1b.)

The Federal government owns over seventy percent (70%) of all the total County land area with the Bureau of Land Management (BLM) having seventy-five percent (75%) of the Federal Government's share, and fifty-five percent (55%) of the total land area in the County.

Of all the total privately-owned (patented) land area, the 21 incorporated cities have jurisdiction over 357,840.10 acres (14.58 %) and the remaining 2,095,919.90 acres (85.42%) fall under the jurisdiction of the County legislative body (see Table 5 which shows the jurisdictional control of all privately owned land in the County.) (Also note that the total privately owned land in the County is 19.19 percent of the total land area; 16.68 percent lies within the unincorporated portion of the County while the 21 cities collectively have jurisdiction over 2.51 percent.)

2. **Existing Land Use**

Table 6 indicates the acreage of existing land uses in the County by major use categories. (Also see Figure 2.) The data presented in the table is adapted from the a land use inventory of the Inland Empire conducted by Southern California Edison (SCE) between September 1986 and March 1987 via aerial photo interpretation.

TABLE 4

JURISDICTIONAL CONTROL OF ALL COUNTY LAND.

Land Owner	Land Area Acres	Land Area Sq. Miles	Percent of Total	Cumulative Percent
National Forest	433,077	676.7	3.35%	3.35%
Bureau of Land Management	7,075,752	10,992.0	54.51%	57.86%
Bureau of Reclamation	36,212	56.6	0.28%	58.14%
Fish & Wildlife	7,612	11.9	0.06%	58.20%
National Park Service	167,523	261.8	1.30%	59.50%
Bureau of Indian Affairs	71,626.88	111.9	0.55%	60.05%
Military	1,867,538	2,918.0	14.47%	74.47%
Army	642,722	1,004.0		
Air Force	57,358	90.0		
Navy	563,342	880.2		
Marines	601,190	939.4		
Army Corps of Engineers	2,926	4.6		
Federal Aviation Agency	1,075	1.7	0.08%	74.55%
Total Public Land	9,632,200	15,050.3	74.55%	
Southern Pacific Railroad	819,000	1,279.7	6.34%	
Total Private Land	2,453,760 (a)	3,834.0	19.19%	

Note: (a) This includes land within the incorporated cities.

Source: San Bernardino County, Office of Planning, 1987.

Figure 1a

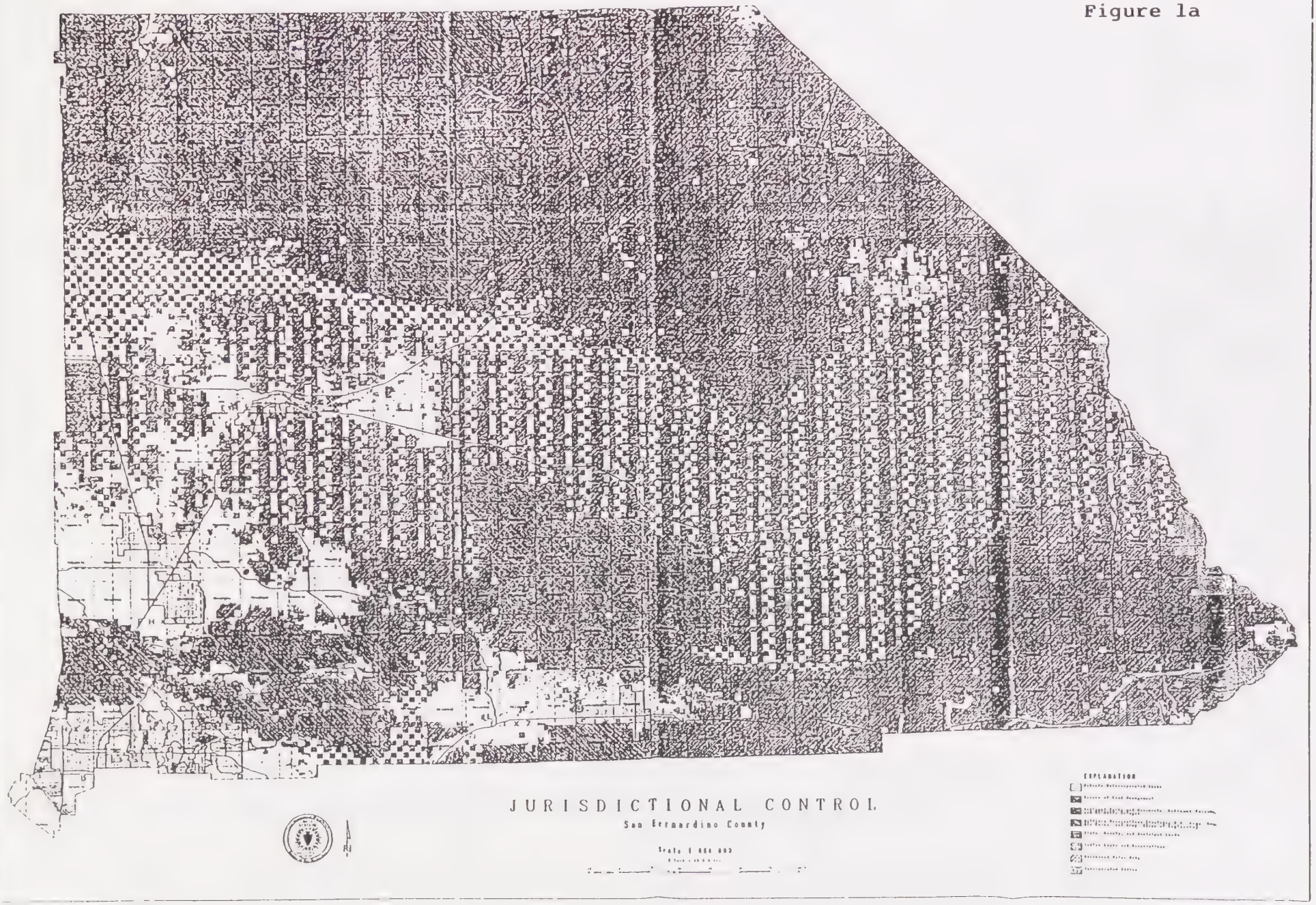

JURISDICTIONAL CONTROL
San Bernardino County
EXPLANATION

Figure 1b

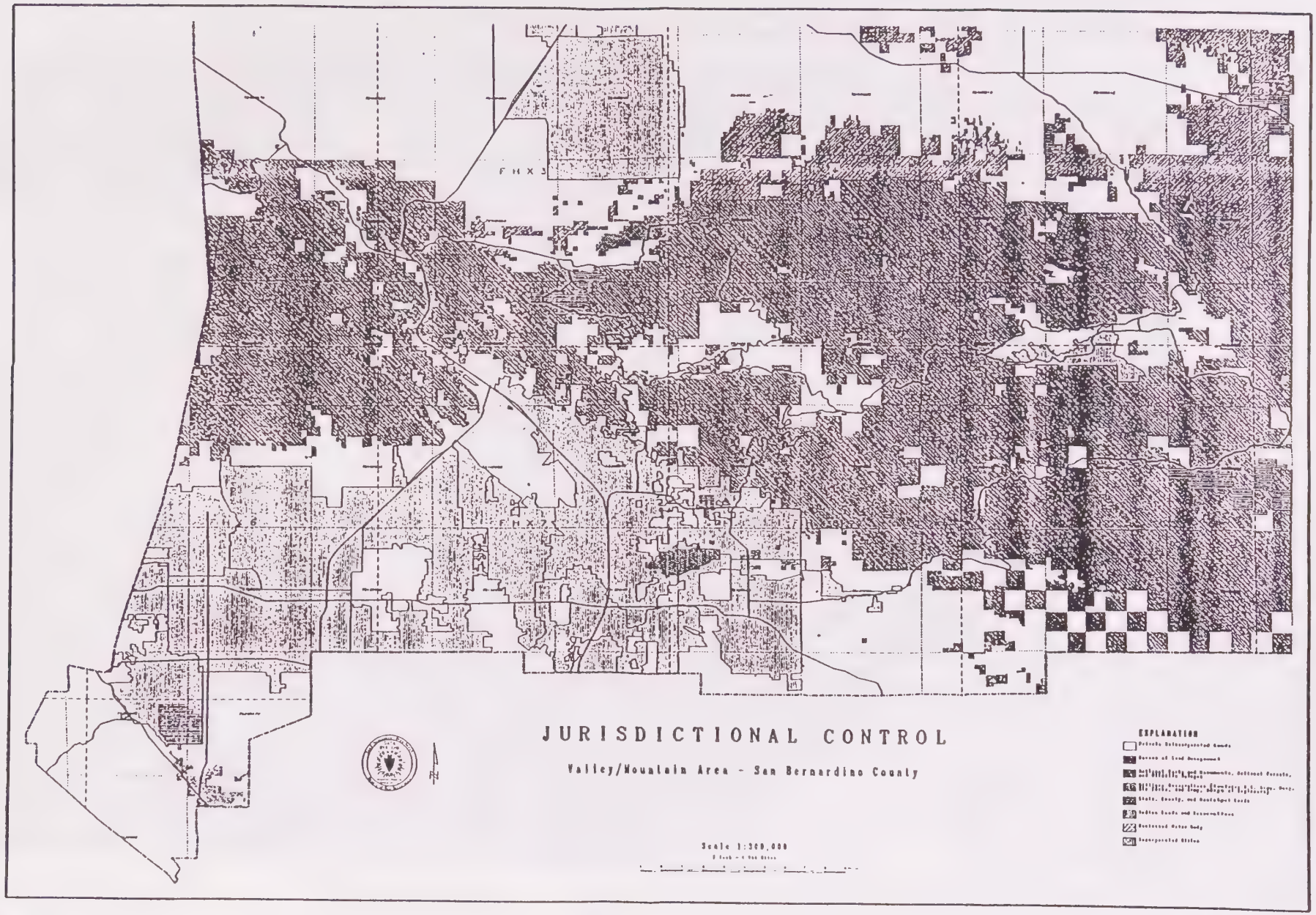

JURISDICTIONAL CONTROL
Valley/Mountain Area - San Bernardino County
EXPLANATION

TABLE 5

LAND ACREAGE WITHIN EACH CITY IN THE COUNTY (1)

City	Acreage	
Adelanto	20,648.09	
Apple Valley	41,600.00	
Barstow	14,670.96	
Big Bear Lake	4,119.75	
Chino	10,823.18	
Colton	9,395.93	
Fontana	22,735.49	
Grand Terrace	2,243.73	
Hesperia (Effective 7/1/88)	35,200.00	
Highland	8,565.73	
Loma Linda	4,143.70	
Montclair	3,234.57	
Needles	18,815.56	
Ontario	23,573.12	
Rancho Cucamonga	22,451.00	
Redlands	15,608.88	
Rialto	13,538.50	
San Bernardino	35,784.96	
Twentynine Palms	34,711.70	
Upland	9,621.36	
Victorville	24,512.02	
Total Incorporated	357,840.10	14.58%
Total Unincorporated	2,095,919.90	85.42%

Note:

(1) May include public parks, public schools and some State lands.

Source: San Bernardino County Office of Planning Data Systems Section, 1988.

Figure 2

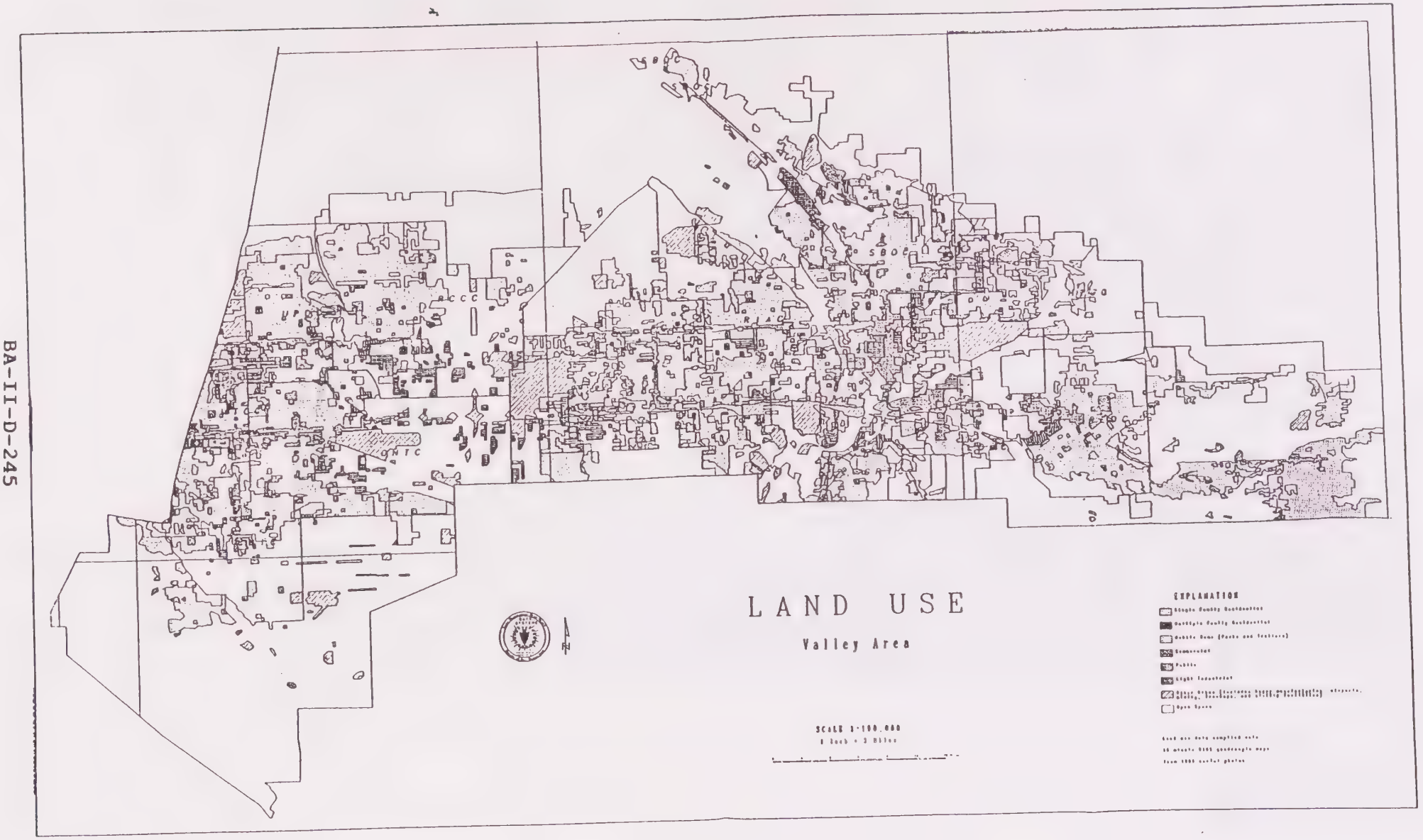


Table 6 shows that residential uses (which include single family and multiple family units as well as mobilehomes) occupying 367,424.1 acres clearly predominate all other use types. Commercial Uses and Light Industrial uses occupy 45,472.8 and 1,545.3 acres respectively while Public uses and Open Space occupy 113,972.6 and 434,889.8 acres respectively. (These figures are for the unincorporated portion of the County only. The pattern of land development is more compact within the incorporated cities than in the unincorporated portions of the County. Per capita consumption of land is significantly higher in the unincorporated portion of the County than in the incorporated areas (see Table 6) Also, the average population density in the incorporated areas is approximately 7.98 persons per acre and 1.92 persons per acre in the unincorporated portions of the County.

There is no consensus as to what the ideal ratios of Residential to Commercial and Industrial uses should be. But when compared to Orange and Los Angeles counties (see Tables 7 and 8) which are considered much more balanced areas from job-housing perspectives, it can be concluded that the County of San Bernardino's development pattern skews in favor of residential development; commercial and industrial development are grossly inadequate at the present time. If the County implements policies in an attempt to rectify the imbalance between jobs and housing, a concerted effort may have to be exerted to encourage commercial and industrial development either by providing incentives for those types of development or instituting disincentives for residential development.

a. Agriculture Uses

Occupying over 93,000 acres of land area, Agriculture is the number two industry in the County with an assessed product valuation of over $550 million in 1987. (Approximately 21,371 acres of agriculture land are in Agriculture preserve, of which approximately 13,430 acres are under the Williamson Act contract.

Of the total land in Agriculture preserve, 9,040 acres is classified as urban prime land, 3,200 acres as other prime land and 9,131 acres as non-prime land. (See Table 9.) Also, see Table 10 for total land acreage under Williamson Act contract statewide.) In recent years, there has been a decline in the amount of land devoted to agricultural uses and the total product valuation of the industry (see Tables 11 and 12 and also, Table 13 which lists the harvested acreage for major crops and their valuation for 1986 and 1987).

The decline of agricultural land is partly due to urban development and other market forces. Figures 3a and 3b show potential growth areas in the County and some of these areas are also major agricultural areas. These areas include Chino area, Yucaipa and Oak Glen. It is widely believed that land used for urban

TABLE 6

EXISTING LAND USES (a)

Use Categories	UNINCORPORATED AREAS			INCORPORATED AREAS		
	Acreage Mar. 87	% of Total	Acreage Per Capita	Acreage Mar. 87	% of Total	Acreage/ Capita
Agriculture	93,045.0	13.80	.079	--		
Residential	367,424.1	54.57	.085	96,540.5	54.18	.127
Commercial	45,472.8	6.76	.106(c)	10,779.4	6.05	.014
Light Industrial (b)	1,545.3	0.23	.003	7,903.7	4.43	.010
Other Urban	51,880.6	7.70	.121	56,040.2	31.45	.074
Public	113,972.6	16.94	.265	6,932.0	3.89	.009
Total Average Used	673,341.8	100.00	1.431	178,195.8	100.00	.234
Open Space/ Vacant	434,889.8			85,009.0		

Notes:

(a) The Land Use inventory conducted by SCE did not cover the more remote desert parts of the County nor the entire mountain region; the total acreage surveyed is approximately 56% of the privately owned land in the County concentrating only in areas of developments. While the data is considered quite accurate in the Valley area, its accuracy in the Desert area is less so.

(b) Heavy industrial uses are classified as part of "other urban uses," which also includes mineral extractions, airports, utility , transportation and communication corridors and waste disposal sites.

(c) This means that each person in the unincorporated portion of the County currently requires over 4600 square feet of commercial land. This is rather high when compared to other jurisdictions. This may be partly due to the fact that commercial development in the County has traditionally been low lying, sprawled out type development.

Source: Southern California Edison Land Use Data, 1987.

TABLE 7

JOBS TO HOUSING RATIOS BY COUNTY

DRAFT

Counties	1984 Jobs	1984 Housing	1984 Ratio*	1984 County/ Region Ratio*	2010 Jobs	2010 Housing	2010 Ratio*	2010 County/ Region Ratio*
Imperial	37,000	33,000	1.12	.88	65,000	60,600	1.07	.89
Los Angeles	4,053,000	2,924,900	1.39	1.09	5,497,000	3,865,400	1.42	1.19
Orange	1,048,000	760,000	1.38	1.09	1,925,000	1,253,500	1.54	1.29
Riverside	247,000	327,000	.76	.60	477,000	919,200	.52	.43
San Bernardino	325,000	408,600	.80	.63	634,000	995,700	.64	.53
Ventura	213,000	196,500	1.03	.85	356,000	385,300	.92	.77
Region	5,923,000	4,650,400	1.27		8,954,000	7,479,600	1.20	

* 1.0 would represent balance (the number of people who work in the county would approximately equal the number of workers who live in the county).

Table 8

COUNTY EMPLOYMENT GROWTH

		Baseline Projection			SCAG-82 Modified		
	1984 Employment	2010 Employment	Growth 1984-2010 (% of Regional Growth)	% Change	2010 Employment	Growth 1984-2010 (% of Regional Growth)	% Change
Imperial	37,000	65,000	28,000 (1%)	76%	69,100	32,100 (1%)	87%
Los Angeles	4,053,000	5,497,000	1,444,000 (48%)	36	5,084,600	1,031,600 (42%)	26
Orange	1,048,000	1,925,000	877,000 (29%)	84	1,565,300	517,300 (21%)	49
Riverside	247,000	477,000	230,000 (8%)	93	587,700	340,700 (14%)	138
San Bernardino	325,000	634,000	309,000 (10%)	95	690,000	365,000 (15%)	112
Ventura	213,000	356,000	143,000 (5%)	67	380,200	167,200 (7%)	79
Region	5,923,000	8,954,000	3,031,000 (100%)	51%	8,376,900	2,453,900 (100%)	41%

JOB-TO-POPULATION RATIOS IN SCAG REGION

	1984	2010 Baseline	2010 SCAG-82M
Imperial	.36	.39	.45
Los Angeles	.52	.57	.58
Orange	.51	.62	.55
Riverside	.33	.24	.42
San Bernardino	.32	.27	.38
Ventura	.37	.35	.41
Region	.48	.49	.53

THE RESOURCES AGENCY - DEPARTMENT OF CONSERVATION
Williamson Act - Open Space Subvention Entitlements
1986-87 Fiscal Year

COUNTY	URBAN PRIME LAND ACRES	URBAN PRIME LAND SUBVENTION @ $8/ACRE	URBAN PRIME LAND ACRES	URBAN PRIME LAND SUBVENTION @ $5/ACRE	OTHER PRIME LAND ACRES	OTHER PRIME LAND SUBVENTION @ $1/ACRE	NONPRIME LAND ACRES	NONPRIME LAND SUBVENTION @ $0.40/ACRE	TOTAL REPORTED ACREAGE	TOTAL ENTITLEMENT
ALAMEDA	4,970	$39,760	0	$0	3,035	$3,035	142,357	$56,943	150,362	$99,738
AMADOR	0	$0	0	$0	3,624	$3,624	89,007	$35,603	92,631	$39,227
BUTTE	15,171	$121,368	0	$0	95,634	$95,634	106,880	$42,752	217,685	$259,754
CALAVERAS	0	$0	0	$0	1,167	$1,167	127,843	$51,137	129,010	$52,304
COLUSA	0	$0	0	$0	10,345	$10,345	190,105	$76,042	200,450	$86,387
CONTRA COSTA	523	$4,184	0	$0	10,704	$10,704	59,491	$23,796	70,718	$38,684
EL DORADO	0	$0	0	$0	1,997	$1,997	43,127	$17,251	45,124	$19,248
FRESNO	51,925	$415,400	0	$0	1,038,783	$1,038,783	438,941	$175,576	1,529,649	$2,084,743 a
GLENN	0	$0	0	$0	77,557	$77,557	245,468	$98,187	323,025	$175,744
HUMBOLDT	0	$0	0	$0	1,734	$1,734	180,671	$72,268	182,405	$74,002
KERN	50,295	$402,360	0	$0	869,158	$869,158	774,776	$309,910	1,694,229	$1,581,428
KINGS	0	$0	48,589	$242,945	410,966	$410,966	145,729	$58,292	605,284	$712,203
LAKE	0	$0	0	$0	6,072	$6,072	43,194	$17,278	49,266	$23,350
LASSEN	0	$0	0	$0	22,541	$22,541	208,468	$83,387	231,009	$105,928
LOS ANGELES	0	$0	0	$0	0	$0	40,052	$16,021	40,052	$16,021
MADERA	0	$0	34,345	$171,725	206,533	$206,533	288,787	$115,515	529,665	$493,773
MARIN	1,384	$11,072	0	$0	8,436	$8,436	83,333	$33,333	93,153	$52,841
MARIPOSA	0	$0	0	$0	0	$0	148,648	$59,459	148,648	$59,459
MENDOCINO	0	$0	0	$0	26,747	$26,747	447,185	$178,874	473,932	$205,621
MONTEREY	2,227	$17,816	0	$0	36,639	$36,639	603,705	$241,482	642,571	$295,937
NAPA	1,695	$13,560	0	$0	5,476	$5,476	39,914	$15,966	47,085	$35,002
NEVADA	0	$0	0	$0	5,639	$5,639	0	$0	5,639	$5,639
ORANGE	2,534	$20,272	0	$0	930	$930	36,040	$14,416	39,504	$35,618
PLACER	0	$0	482	$2,410	24,589	$24,589	44,291	$17,716	69,362	$44,715
PLUMAS	0	$0	0	$0	7,113	$7,113	75,664	$30,266	82,777	$37,379
RIVERSIDE	7,003	$56,024	0	$0	58,987	$58,987	10,147	$4,059	76,137	$119,070
SACRAMENTO	8,395	$67,160	0	$0	103,868	$103,868	122,179	$48,872	234,442	$219,900
SAN BENITO	0	$0	8,579	$42,895	41,035	$41,035	500,711	$200,284	550,325	$284,214
SAN BERNARDINO	9,040	$72,320	0	$0	3,200	$3,200	9,131	$3,652	21,371	$79,172
SAN DIEGO	3,425	$27,400	0	$0	16,360	$16,360	114,646	$45,858	134,431	$89,618
SAN JOAQUIN	126,151	$1,009,208	0	$0	262,935	$262,935	153,828	$61,531	542,914	$1,335,894 a
SAN LUIS OBISPO	7,577	$60,616	0	$0	67,481	$67,481	675,480	$270,192	750,538	$398,289
SAN MATEO	595	$4,760	0	$0	1,057	$1,057	42,896	$17,158	44,548	$22,975
SANTA BARBARA	29,359	$234,872	0	$0	35,506	$35,506	459,836	$183,934	524,701	$454,312
SANTA CLARA	15,196	$121,568	0	$0	2,410	$2,410	347,984	$139,194	365,590	$263,172
SANTA CRUZ	0	$0	1,719	$8,595	1,837	$1,837	8,408	$3,363	11,964	$13,795
SHASTA	457	$3,656	0	$0	11,657	$11,657	138,440	$55,376	150,554	$70,689
SIERRA	0	$0	0	$0	1,953	$1,953	32,832	$13,133	34,785	$15,086
SISKIYOU	0	$0	0	$0	83,963	$83,963	299,117	$119,647	383,080	$203,610
SOLANO	35,897	$287,176	0	$0	97,119	$97,119	170,376	$68,150	303,392	$452,445
SONOMA	5496	$43,968	0	$0	24,035	$24,035	238,386	$95,354	267,917	$163,357

TABLE 10

LAND UNDER WILLIAMSON ACT CONTRACT - STATEWIDE

FISCAL YEARS	ACRES UNDER ACTIVE CONTRACT	ACRES NONRENEWED	ACRES CANCELLED	NET CHANGE
1972-73	11,440,008	N/A	N/A	N/A
1973-74	12,719,388	N/A	N/A	+1,279,380
1974-75	13,742,005	4,323	788	+1,022,617
1975-76	14,427,087	5,775	2,875	+ 685,082
1976-77	15,073,341	8,418	645	+ 646,253
1977-78	15,625,461	4,500	548	+ 552,120
1978-79	16,126,498	14,385	697	+ 501,037
1979-80	16,179,417	53,811	4,506	+ 52,919
1980-81	16,222,161	44,571	2,536	+ 42,744
1981-82	16,211,160	51,565	3,874	- 11,001
1982-83	15,179,233	90,900	5,789	-1,031,927
1983-84	15,156,889	51,147	1,071	- 22,344
1984-85	15,174,354	39,069	10,931	+ 17,465
1985-86	15,325,502	41,908	5,821	+ 151,148
1986-87	15,455,225	60,339	4,950	+ 129,723

Table 11

LAND ACREAGE FOR AGRICULTURAL USES 1981-87 (a)

Year	Acreage	% change
1981	102,200	
1982	105,283	+3
1983	99,841	-5.2
1984	101,772	+1.9
1985	102,071	+0.3
1986	97,662	-4.5
1987	93,045	-4.9

Note :

(a) Incorporated and Unincorporated areas.

Source: San Bernardino County Department of Agriculture, Farm Reports 1981-1987.

TABLE 12

AGRICULTURE INDUSTRY

Ten Year Summary

Year	$ All Crops	$ All Poultry	$ Other Livestock	$ Total
1978	53,492,300	76,957,000	255,737,000	386,186,300
1979	47,597,700	82,642,000	323,492,900	453,732,600
1980	62,937,300	87,698,000	364,807,200	515,442,500
1981	55,532,100	93,681,000	402,943,000	552,156,100
1982	71,949,720	84,983,000	400,388,000	557,320,720
1983	66,213,360	81,383,000	387,417,000	535,013,360
1984	82,619,900	85,729,000	391,018,000	559,366,900
1985	84,528,600	74,936,000	399,509,100	558,973,700‡
1986	81,945,300	77,295,000	396,451,000‡	555,691,300‡
1987	79,154,400	63,358,000	407,683,000	550,195,400

‡Revised

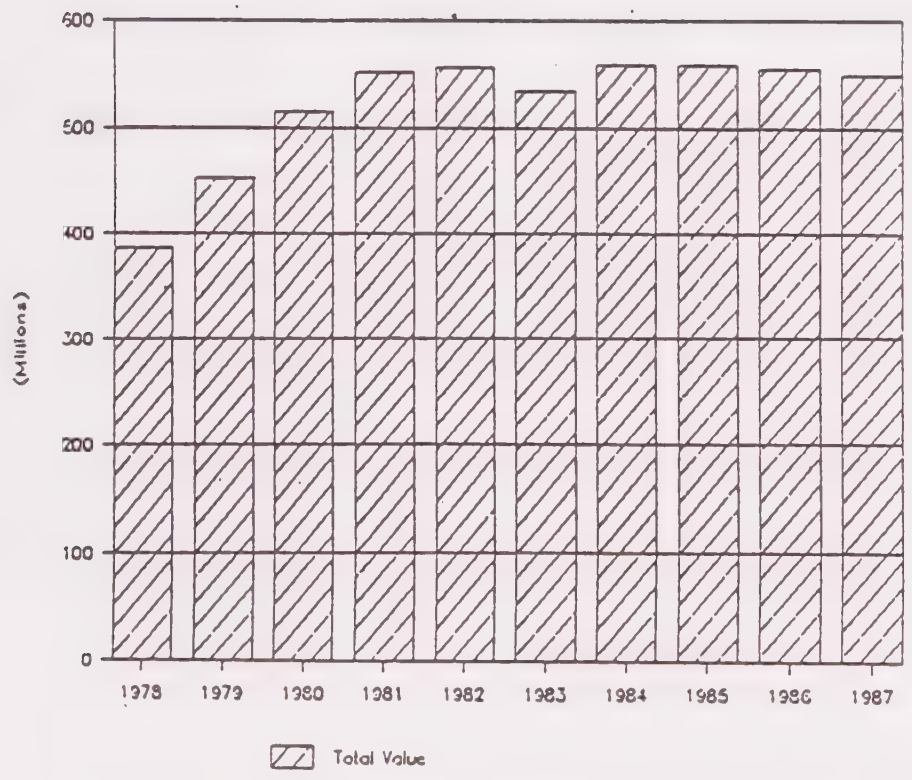


TABLE 13

AGRICULTURAL INDUSTRY HARVESTED ACREAGE 1986/1987

Item	Harvested Acreage 1986	Harvested Acreage 1987	$ Valuation 1986	$ Valuation 1987
Apples	298	310	362,000	636,000
Avocados	188	197	126,000	49,000
Grapes	4,450	3,522	1,035,000	1,741,000
Citrus	7,735	7,397	23,842,000	22,709,000
Kiwi Fruit	22	22	18,900	56,600
Deciduous, Other	280	484	211,000	681,900
Seeds	910	1,032	421,000	268,000
Strawberries	235	263	4,728,000	5,063,000
Vegetables	1,993	1,670	12,390,000	9,898,000
Apiary			817,300	560,100
Field Crops	80,910	77,618	22,988,900	21,278,800
Nursery Products	551	530	14,850,400	15,953,000
Livestock and Poultry			472,807,000‡	469,591,000
Aquaculture			939,000	1,450,000
Timber			114,000	260,000
TOTALS	97,622	93,045	555,691,300‡	550,195,400

‡Revised

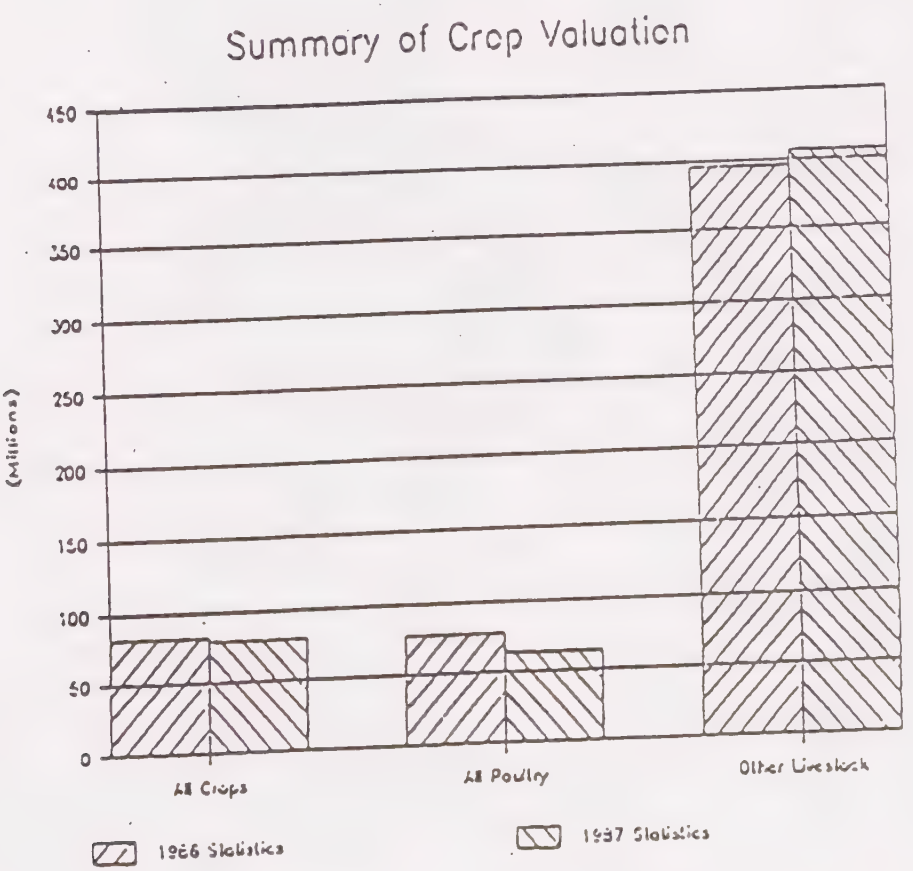
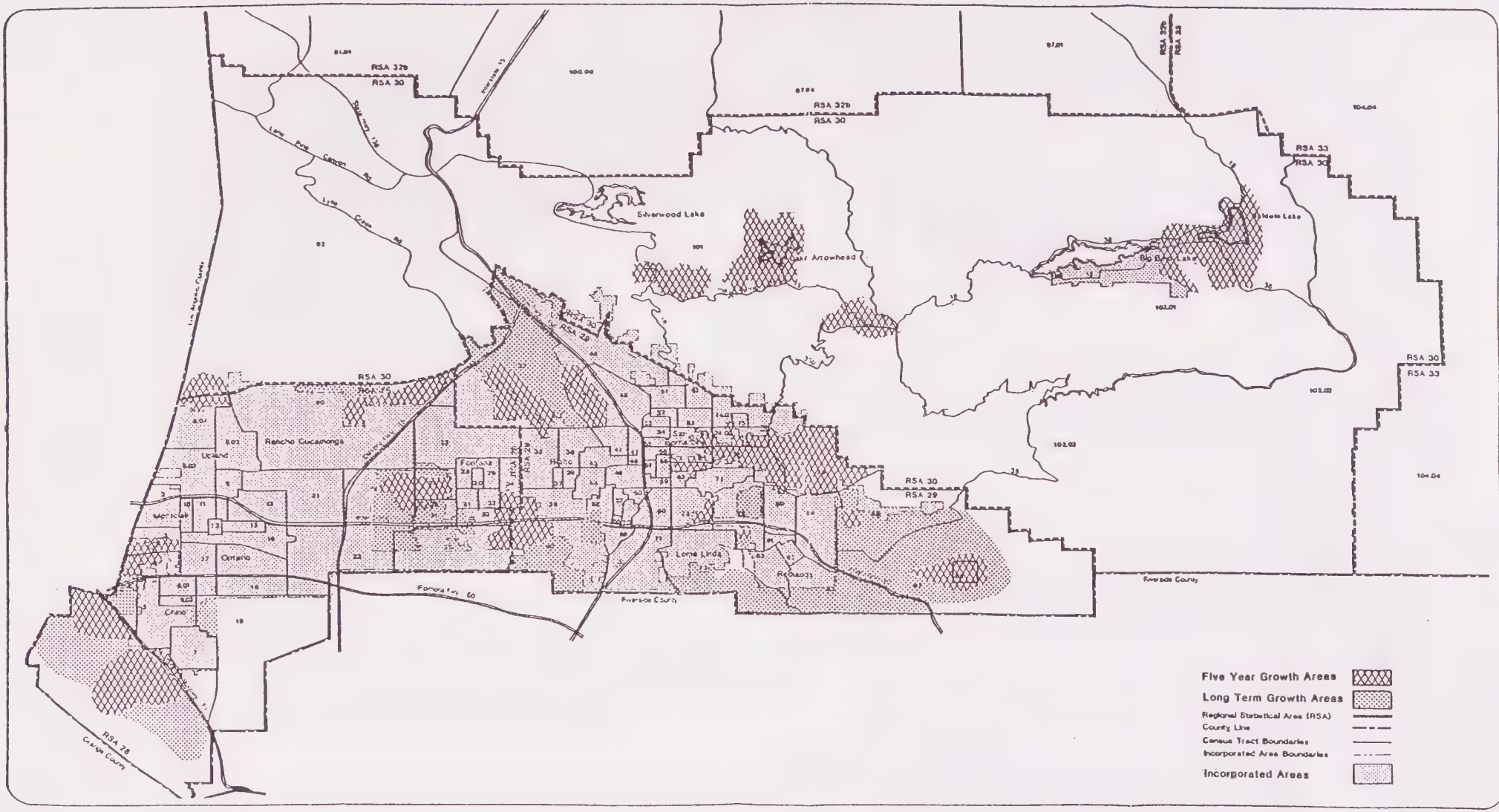
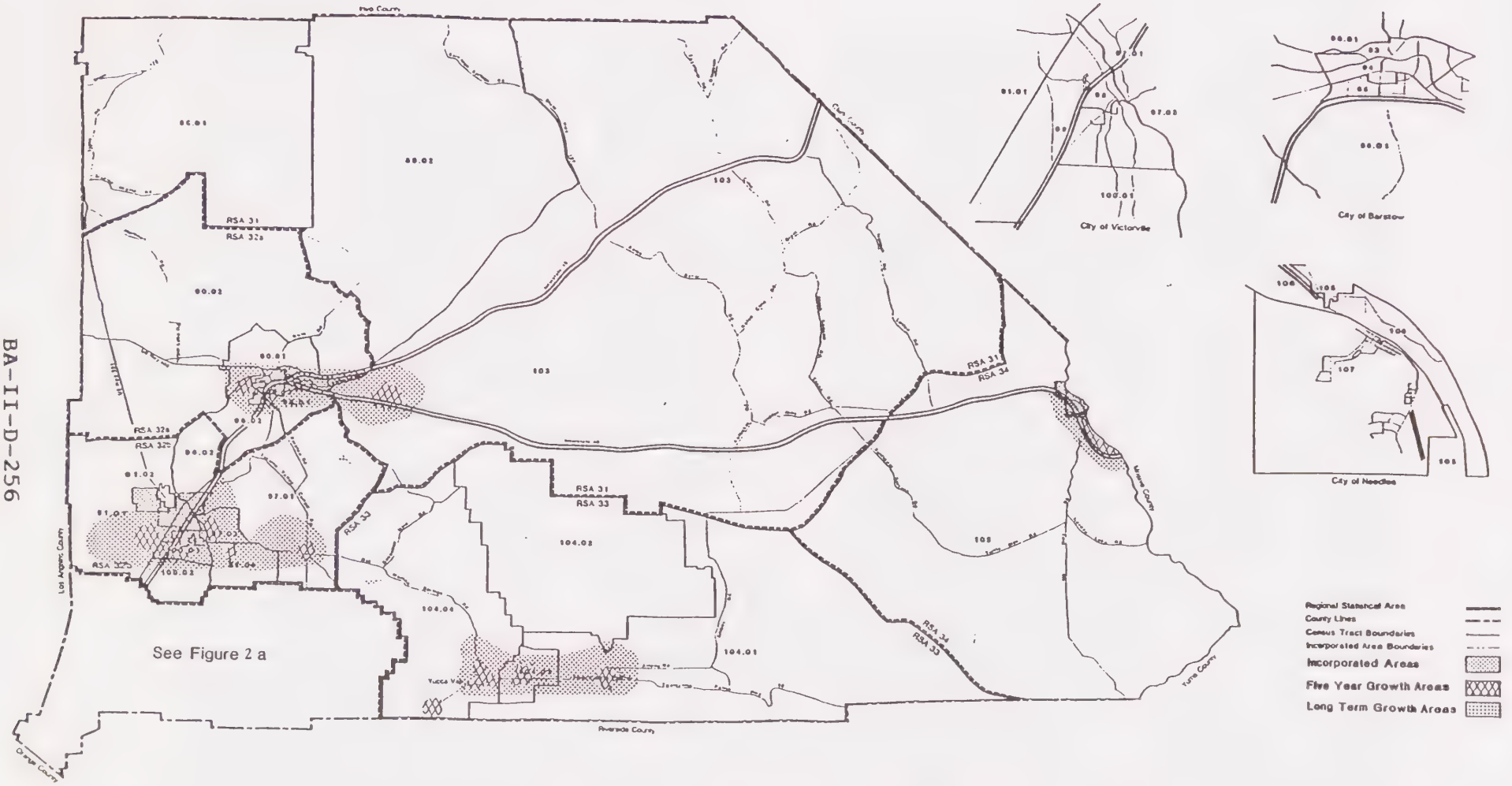


Figure 3a



Potential Growth Areas

Figure 3b



BA-II-D-256

Potential Growth Areas

development is worth much more than land used for agriculture. Therefore, in any potential battle between agriculture and rapidly approaching urban developments, agriculture uses often lose. The State Department of Water Resources estimated that every year between 1972 and 1980, 44,000 acres of cropland were converted statewide to urban and suburban development. (California Lawyer, August 1986.) The most vulnerable agricultural lands are those located in urbanizing areas adjacent to metropolitan areas where development is spreading.

Urbanization affects the agricultural industry in two ways. First, most development takes place on prime agriculture land, because this land is fairly flat and well-drained, and provides the easiest and most suitable building types. Second, as prime lands become urbanized, some agriculture gets replaced on lands that are not as suitable (e.g. hillside areas), or as fertile and productive as the original fields. The net effect is that the amount of vacant land that can be converted to viable cropland is quickly dwindling. The predicted population growth over the next twenty years may culminate in the reduction of the total acreage for agricultural uses especially in the Chino area and East San Bernardino Valley. The County may have to institute stronger measures to protect viable agriculture land from urban encroachment.

b. Residential Uses

The number of housing units in the incorporated portion of the County increased by 46,861 (from 155,526 in 1981 to 202,387 in 1988.) (See Table 14.) This was an increase of over thirty percent (30.13%) over the seven-year period. In 1988, seventy percent comprise duplexes, multiple family residential units and mobile homes.

In 1987, a total of 7,744 permits were issued for residential development (not including mobile homes) by the Office of Building and Safety. The estimated valuation for all the residential developments for that year was 686,598,194 dollars. (See Table 15.) From the table, it is evident that, although most residential development activity took place in the Valley (East and West) in 1987, the North Desert, (Victor Valley area) is clearly the fastest growing area, while the Morongo basin recorded the least number of residential permits. With the amount of unincorporated privately owned and developable vacant land in the Valley rapidly dwindling and becoming more expensive, the North Desert clearly stands out as a potential future growth area. However future growth in the North Desert is conditioned on the availability of the additional demand for water and the required public services and infrastructure facilities.

Table 14

HOUSING UNITS BY TYPE 1981 - 1988 (a)

Year (b)	Single Family	Multiple Family	Mobile Homes	Total	% Change
1981	124,314	16,371	14,841	155,526	-
1982	127,671	16,796	15,277	159,744	2.71
1983	130,377	17,352	16,077	163,806	2.54
1984	134,290	18,339	16,421	169,050	3.20
1985	138,760	20,162	16,282	175,204	3.64
1986	142,927	22,196	17,063	182,186	3.98
1987	149,134	25,193	17,357	191,684	5.21
1988	157,763	27,225	17,339	202,387	5.58

Note:

(a) Unincorporated Portion of the County Only.

(b) As of January 1 of each year indicated.

Source: San Bernardino County Office of Planning.

Table 15

NUMBER OF RESIDENTIAL PERMITS AND ESTIMATED VALUATION (1)

Year	West Valley	East Valley	Mountain	North Desert	Morongo Basin	Total
1983						
(a)	351	343	806	2422	708	4630
(b)	28,502,774	35,050,892	56,884,112	193,303,174	48,754,506	362,495,458
1984						
(a)	516	531	637	2771	707	5162
(b)	47,856,300	53,602,626	44,982,203	240,706,237	48,151,417	435,298,783
1985						
(a)	428	487	468	3546	681	5824
(b)	44,354,874	62,371,510	34,518,800	270,981,990	51,938,116	364,165,290
1986						
(a)	1764	761	532	4592	897	8546
(b)	184,493,990	82,138,377	43,295,456	396,248,763	72,252,959	778,429,545
1987						
(a)	2216	1254	497	3312	455	7744
(b)	208,534,394	122,725,913	37,153,252	282,803,609	35,381,026	686,598,194

Note:

(1) Unincorporated Portion of the County Only

(a) Number of Permits
(b) Estimated Valuation of Development

Source: San Bernardino County Land Management Department

Currently, residential uses in the unincorporated portion of the County occupy 367,424.1 acres which is 54.57 percent of the total developed land area.

From the data presented in Table 6, per capita consumption of residential land in the unincorporated portion of the County is six times that of the incorporated area. The cost of providing infrastructure facilities and public services is likely to be significantly higher in the unincorporated portion of the County because of this sprawled urban form.

c. Commercial Uses

Commercial uses occupy 45,472.8 acres or 6.76 percent of the total developed land in the incorporated portion of the County. (See Table 6.) The existing commercial uses translate to 106 acres per 1000 persons. The service jobs generated by the existing commercial ventures are inadequate for the County's population. And, commercial development is currently being outpaced by residential development. In 1987, the County issued a total of 7,744 building permits for residential uses having an estimated valuation of 686,598,194 dollars (Table 15). In the same year there were only 296 permits for commercial uses with a total estimated valuation of 53,085,191. (See Table 16.)

The additional population that reside in newly constructed housing units will require public services that often exceed their contribution to the general fund in the form of property taxes. The Department of Economic and Community Development actively seeks out businesses and provides incentives for them to locate in the County. This policy is expected to provide needed employment opportunities and expand the County's tax base.

d. Industrial Uses

Of all use types, industrial uses provide the most stable tax base; they provide jobs for residents and import revenues from other areas into the County. But, like commercial development, the rate of industrial development in the County has been rather slow. In 1987, a total of 158 building permits for industrial uses were issued. The estimated valuation of the projects was $47,249,100. (See Table 17). The estimated valuation of permitted residential projects in the same year was $686,598,194 (see Table 15). While most of the industrial permits were issued in the Valley areas of the County, the estimated valuation of industrial projects in the North Desert was proportionately higher. Other than the Mountain areas where physical constraints and current zoning regulations inhibit development of industrial uses, the Morongo basin recorded the least number of permits for industrial uses.

Table 16

(1)

BUILDING PERMITS FOR COMMERCIAL USES 1983 - 1987

Year	West Valley	East Valley	Mountain	North Desert	Morongo Basin	Total
1983						
(a)	37	36	16	113	26	231
(b)	7,829,548	4,611,635	2,484,784	14,239,386	5,131,227	34,296,580
1984						
(a)	54	63	26	116	41	300
(b)	12,663,255	10,435,356	4,860,236	22,639,296	7,132,143	57,730,286
1985						
(a)	73	30	27	141	25	296
(b)	13,484,539	2,867,776	4,220,725	24,084,834	4,092,470	48,750,344
1986						
(a)	66	50	23	145	36	320
(b)	8,872,969	8,259,553	2,371,760	22,398,844	5,244,136	47,147,262
1987						
(a)	42	37	16	169	32	296
(b)	5,976,141	7,959,482	2,622,140	33,844,298	2,683,130	53,085,191

Notes:

(1) Unincorporated Portion of the County Only

(a) Building Permits
(b) Estimated Valuation of Development

Source: San Bernardino County Land Management Department

Table 17

(1)

BUILDING PERMITS AND ESTIMATED VALUATION FOR INDUSTRIAL USES 1983 - 1987

Year	West Valley	East Valley	Mountain	North Desert	Morongo Basin	Total
1983						
(a)	3	None	None	5	None	8
(b)	265,220			1,366,865		13,940,020
1984						
(a)	15	None	None	12	None	27
(b)	3,580,707			11,774,664		15,355,371
1985						
(a)	17	3		8	None	30
(b)	2,968,607	162,800	102,437	4,131,035		7,364,879
1986						
(a)	43	10	None	13	1	67
(b)	8,718,499	5,108,700		15,950,892	32,400	29,810,491
1987						
(a)	63	21	1	68	5	158
(b)	13,559,128	3,190,809	89,680	28,416,653	1,992,830	47,249,100

Notes:

(1) Unincorporated portion of the County only.

(a) Building Permits.
(b) Estimated Valuation of Projects.

Source: San Bernardino County Land Management Department.

Industrial uses currently occupy 1,545.3 acres or 0.23 percent of the total developed land in the County. This translates to 3 acres per 1000 persons. The evident imbalance between jobs and housing countywide suggests that efforts may be concerted to expand the industrial sector of the economy. However, whatever policies are pursued by the County regarding future development of industrial uses, the natural constraints of the desert areas and air pollution problems of the basin should be considered.

c. Subregional Land Use Characteristics and Potential Growth Areas

Figures 3a and 3b identify potential growth areas in the four major regions of the County. Detailed land use characteristics and development constraints of each of the eight subregions are discussed below.

West Valley (RSA 28)

Most of the land in the West Valley region is incorporated; therefore, most of the region's future development is expected to be directed to the cities and their spheres of influence areas. Two unincorporated areas are also expected to grow rapidly during the plan period - the Chino Hills Specific Plan and the West Valley Foothill Community Plan areas. Some cities are experiencing rapid growth and strains on existing facilities. However, there are still vast vacant areas with services available or planned.

Through annexations and possible incorporations, the amount of private land under the jurisdiction of the County will continue to decrease. With this, the County's role in regional planning issues can be expected to expand, especially in areas of transportation/traffic, air quality, ground water supply and quality and economic development strategies.

The Chino Hills Specific Plan which covers a land area over 18,000 acres was adopted in 1982 and is the largest Specific Plan in the State covering more than 18,000 acres. At buildout the Plan might expect about 30,000 dwelling units with a population of approximately 100,000. According to development approvals, about 3,820 new dwelling units will be constructed in the next three years (1,325 single family and 2,495 multiple family units). Recently, there have been problems associated with the infrastructure financing plans for the Plan area; the rate of private development is seemingly outpacing the rate of providing needed facilities and services. Development fee formulas and financing mechanisms are therefore being reexamined.

The West Valley Foothill Community Plan was adopted in 1983 and lies north of the cities of Upland, Rancho Cucamonga and Fontana. This area has received little development pressure until recently when major improvements such as flood control were installed. However, this area, (approximately 16,782 acres, of which 303 acres have been annexed to the city of Rancho Cucamonga) is slated for growth in the near future, partly because of its proximity to major urban areas such as Rancho Cucamonga, Upland, Ontario, Chino and Fontana where the amount of vacant developable land is becoming limited. At the time of writing, the total number of dwelling units in all the development proposals that have been submitted for the Plan area is 3,278, and of these, tentative approval has been granted for only 546 units. Developers and builders are currently investigating financing options and strategies to provide the needed infrastructure and services for the proposed developments of the area.

South of the City of Ontario, the Chino Agricultural Preserve was established by the County in 1968 under the authority granted by the Williamson Act. This Act was designed to protect agricultural land use from urban intrusion by allowing preferential taxing through contracts. In exchange for keeping land in agricultural use, property owners would be taxed at agricultural value. Currently, more than 11,500 acres remain in Preserve status, eighty percent (80%) of which is under contract. The area contains one of the largest concentrations of dairy cows in the world. The dairy industry continues to be one of the most valuable industries in the County. There have been tremendous pressures to convert the Preserve to urban use, but after two major studies, the Board of Supervisors, in 1987, adopted several policies designed to maintain and enhance the Preserve through 1997 at the earliest. If eventually converted to urban residential use, this area could potentially add another 250,000 people to the West Valley population.

There still remains a large block of unincorporated land, about 10 square miles, in the Fontana sphere area. There are a mixture of industrial and residential uses in this area. Other smaller islands of unincorporated land are largely within city spheres of influence and are mostly developed.

Air Quality, job/housing balance, traffic congestion, inadequate waste disposal facilities and the maintenance of the quality of potable water in the region are some of the regional issues to be addressed as the West Valley continues to grow. Planning studies are currently underway between the County and the cities of Montclair and Fontana regarding future development in the spheres of the two cities. The onus of the planning effort is to ensure that uses permitted in the spheres are compatible with the uses

permitted in adjacent city boundaries. Also, the development standards that will be applied within the SOI areas will be negotiated and will reflect the desires of both the County and the cities.

East Valley (RSA 29)

Most of the East Valley is also incorporated. Growth is expected to occur about evenly between cities and unincorporated land. The County has prepared sub-area plans for Bloomington in 1980, East Loma Linda/West Redlands in 1980, Yucaipa in 1980, Oak Glen in 1980, Agua Mansa in 1986, and the East Valley (I-10) Corridor. There are also a large number of unique, identifiable, unincorporated communities which are all experiencing growth pressures. Many of these areas are established older communities which are experiencing infilling and increased densities. Displacement of rural and agricultural uses and capacity of sewage treatment facilities are major concerns. At the fringes of existing urban areas, major planned development projects including Chapman Ranch and Sunrise Ranch are being processed. Many of the unincorporated communities contain older housing stock and the potential for eventual redevelopment must be considered. Lagging behind residential development throughout the East and West Valley has been the creation of jobs. The Agua Mansa Specific Plan, adopted in 1986 is a multijurisdictional effort aimed at promoting industrial development.

Areas experiencing significant amounts of growth pressures include the Mentone-Crafton area and the unincorporated area between Loma Linda, Redlands and the city of San Bernardino. The Mentone-Crafton area has a development potential of 20,700 units under current land use and zoning designations. A significant number of vacant lots and large residential parcels are also available in Yucaipa and North Rialto. Development in these areas is, however, constrained by an inadequate sewer system; development is to a large extent limited to large lots, 1/2 acres or larger, or infilling of sphere of influence areas where sewer systems and sewerage facilities are readily available. The Bloomington and Devore/Muscoy areas are also designated for large lot residential development (although development in the adjacent incorporated areas is at higher densities) mainly because of community preference for estate type development and absent sewerage facility and system.

Inadequate infrastructure is a major constraint to development in the East Valley region. Most of the communities are old and the existing infrastructure was sized for lower density, scattered development. The water system of the area is inadequate to meet current demand. Most of the development in Yucaipa, Mentone and Bloomington are currently on septic systems posing potential groundwater contamination problems.

The East Valley also contains a variety of physical hazards and constraints including flood hazard and major earthquake fault lines that transverse the area. The steep slopes of the mountains to the North and South of the region channel runoff to the rivers and creeks in the area; the Santa Ana River runs through the East Valley and the area is crisscrossed by a network of creeks and drainage channels. The East Valley region also contains several archeological and historical sites which may limit development in certain areas. These historical/archeological resources include cobblestone-lined drainage channels built by the Indians and Victorian homes built in the late nineteenth and early twentieth centuries.

Mountains (RSA 30)

The Mountain region is the smallest and least populated of County regions. Several Community plans have been prepared: Lytle Creek - 1981, Lake Arrowhead - 1981, Hilltop - 1985, Crest Forest - 1983 and Bear Valley expected to go to hearing later in 1988. Most of the land within the Mountain region is under the control of the U.S. Forest Service. Most of the privately-owned developable (usually less than 30% slope) land in the Mountain Region has been subdivided but large acreages are yet to be developed. The area has long been a resort and second home retreat, but there has been a steady increase of permanent residents in the region since 1970. Since much of the original land division was for recreational uses, it involved small lots for vacation homes. Large areas were subdivided into 2500 square feet tent lots (25'x 100') with no streets or infrastructure facilities planned or required. There are approximately 42,000 such lots in the unincorporated portion of the Mountain region. The lot merger ordinance adopted in November 1986 has provisions requiring that these "substandard lots" be merged to county standards (7200 square feet) before they can be developed.

Most of the development in the Mountain region has been single family detached units and this pattern is expected to continue in view of the physical/natural constraints of the region and the lack of adequate water supply and infrastructure facilities needed to support high density development. Most of the future growth in the region is expected to occur in the Crest Forest and Hill top community plan areas mainly because of their proximity and easy accessibility to the employment centers in the Valley. These areas also have the potential to develop adequate water and sewer system.

Generally, the Mountain region is faced with a host of natural and man-made constraints that considerably limit the developability of the region:

- Existing roads are narrow and winding and the existing development patterns in the region makes it almost impossible or economically infeasible to widen the roads.

- The physical features of the region and the limited circulation system in many areas significantly limit accessibility of emergency vehicles as well as delivery of service.

- The physical features, the abundant vegetation and the rugged terrain make the region a major fire hazard area.

- Existing sewer systems are at or nearing capacity in all the Community Plan areas and there are problems of infiltration into the lines in winter.
- There is potential groundwater overdraft in the area around Big Bear and Baldwin Lakes.

- Steep slopes limit the area available for development as well as the density.

- There is a potential disruption to the region's ecology resulting from erosion of the vegetation on the slopes into the streams and lakes.

- Active earthquake faults that transverse the region and the possible occurrence of landslides and mudflows also limit the development potential of the region.

The Desert Region

The Desert Region has approximately 90 percent of the total land area in the County, the vast majority (over 80 percent) of which is administered by the Bureau of Land Management (BLM) and the Department of Defence (DOD). In addition, a substantial portion is under the control of the State Land Commission and the Southern Pacific Railroad. The area is also important to regional energy transmission and transcontinental telecommunication systems. The Desert has been in discussions regarding potential sites for low level radioactive waste disposal, and the magnetic levitation train proposed to run from Ontario to Las Vegas.

Mining, which is the County's number one industry, is one of the predominant non-residential use types in the region. Agricultural activities have increased in some Desert areas in recent years partly because of the loss of prime agricultural land to urban development in the Valley region. Since 1975, there has been a tremendous surge of population in the North Desert region especially in the Victorville Subregion (RSA 32b). This rapid growth has placed substantial strain on the existing infrastructure facilities (such as sewer and water systems and transportation) which were not originally designed for very large population and

high density development. Many of the concerns regarding the inadequacy of these facilities to support and sustain continuous population increase are being studied as part of the Victor Valley Infrastructure Enhancement Program (VVIEP), which is a multi-agency effort to assess current infrastructure deficiencies and future needs, and to recommend an alternative infrastructure plan and financing methodology. The County is the lead agency and coordinator of the program.

Another major constraint to future development in the region is the demand placed on domestic water supply by the additional population. Currently, domestic water supplies are totally derived from groundwater resources which are all in an overdraft situation. Some aquifers are even being mined, that is, extractions are occurring beyond a safe yield. The County may wish to:

(1) institute water conservation policies (such as those currently in effect in Newberry Springs);
(2) introduce measures such as groundwater recharge and on site water re-use to alleviate immediate water shortage possibilities;
(3) condition future development on proven water supplies or imports.

Housing in the Desert is the most affordable in the County. This affordability is in part due to less expensive land. Many areas have been subdivided into 2 1/2 acre parcels with few if any improvements or even legal access. If and when these lots are developed, fees may have to be assessed at the building permit stage to provide basic levels of improvements such as paved streets.

New Desert cities have formed in Apple Valley, Hesperia and Twentynine Palms while several other cities are expanding their boundaries and spheres of influence. Two community plans were started by the County and have not yet been completed, Phelan and Newberry Springs/Harvard. In addition, the triangle of land between the I-15, Highway 395 and Bear Valley is the target of a potential specific plan.

Baker Subregion (RSA 31)

The Baker Subregion is part of the sparsely settled area of the Desert. Large tracts of land are in military installations (Fort Irwin and portions of the China Lake and Edwards Air Force Base facilities) or used for mining. Very little growth is expected to occur in the Baker area; the little growth that occurs is expected to be around existing communities of Newberry Springs, Searles Valley and Baker.

The lack of infrastructure facilities and delivery systems are major constraints to future development in this subregion. Groundwater is available along Mojave River but not in other areas; outlying housing developments rely on water haulers. All existing development is on septic systems and no sewers are expected to be added in the near future. Improved roads even in the established communities are limited to major highways only; most roads in outlying areas are unpaved. Development in the Baker subregion is further limited by the rugged terrain, the fragile nature of the desert ecosystem and the potential for flash floods especially in the low lying areas.

Barstow Subregion (RSA 32A)

Most of the future growth in the Barstow subregion is expected to occur in the incorporated city of Barstow itself, and in Lenwood and other adjacent unincorporated areas. The main constraint to development in this area is the threat of shortage of potable water. Water in the region comes from the Mojave River which is also the source for the rapidly growing communities of Victorville, Hesperia, Apple Valley and Adelanto. Many studies have concluded that the Mojave will not be adequate to serve the buildout population for all these communities if they are developed at currently planned densities. The fragile desert ecosystem is also an environmental constraint that may limit future development.

Victorville Subregion (RSA 32B)

The Victorville area has been one of the fastest growing areas in San Bernardino County, and the focus of most of the growth has been the newly incorporated cities of Hesperia and Apple Valley. Lucerne Valley remains relatively rural and sparsely developed. These areas and Phelan have few large blocks of privately owned undeveloped land. As other remaining areas are committed, these areas may be looked at as the next long term development potential. Currently there is little infrastructure to support the potential buildout capacity of the area. In addition, even without approving more subdivisions, there are thousands of vacant lots already created which have the potential to develop. The County is currently preparing a Special Land Use Plan for Phelan. The "Golden Triangle" which is bounded by Interstate 15 on the East, Highway 395 on the West, Bear Valley cutoff to the North and the California aqueduct to the South is a major potential growth area. This area would seem to benefit from a comprehensive plan rather than to allow piecemeal development occur which may inhibit logical service extensions and improvements.

Population growth, desired lifestyle, water quality and supply, infrastructure and services and the overall carrying capacity of the Desert are major issues that will need to be resolved in this subregion.

Twentynine Palms Subregion (RSA 33)

This subregion includes the unincorporated communities of Morongo Valley, Yucca Valley, Joshua Tree and the newly incorporated city of Twentynine Palms all of which have had community plans prepared. Theoretically this subregion is expected to accommodate up to 102,500 units but the carrying capacity of the existing infrastructure facilities may demand a reassessment of this estimate; the real future growth may be significantly less. The State Department of Health has issued warnings and have of late refused to approve major developments in Morongo Valley and Yucca Valley because of the water quality and water pressure in smaller, privately owned water districts. Some of the water districts have neither the facilities nor the distribution capacities to meet state standards. Also, concerns have been expressed over the fluoride and mineral salt contents of the water in the Twentynine Palms area.

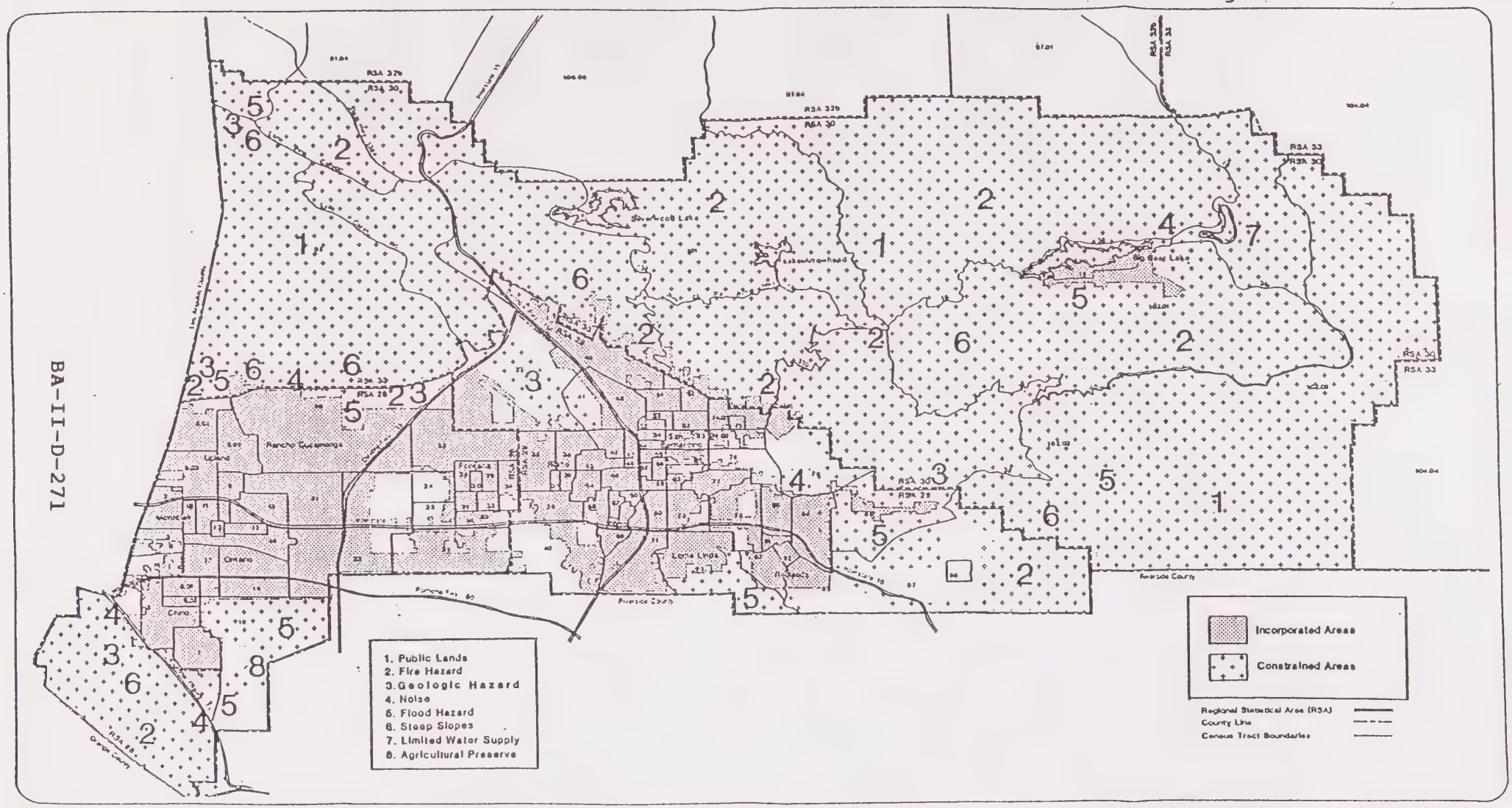
The other major constraint to future development in the subregion is limited accessibility; access to the area is limited to Highway 62 (Twentynine Palms Highway) and Highway 247 (Old Woman's Springs Road). The road serves as the main thoroughfare as well as the node for commercial activities through the communities that they serve.

Needles Subregion (RSA 34)

This subregion is currently sparsely developed. Development in the area is concentrated along the Colorado River adjacent to and south of the City of Needles. Most of the growth has been seasonal (mainly resort, recreational and retirement related). The lack of infrastructure facilities in the area is the major constraint to development. There are no sewers, so lots of one-half acre or more are required for septic systems. Water supply is predicted to be adequate for future demand but there have been problems with high mineral content. The existing circulation system is currently adequate although there are traces of congestion on holidays and summer weekends.

The ecology of the desert/river region is one of the constraints to future development in the area. Also, the area along the Colorado River is subject to seasonal flash flooding and overflow. (Please see Figures 4a and 4b for development constraints of all the eight major subregions.)

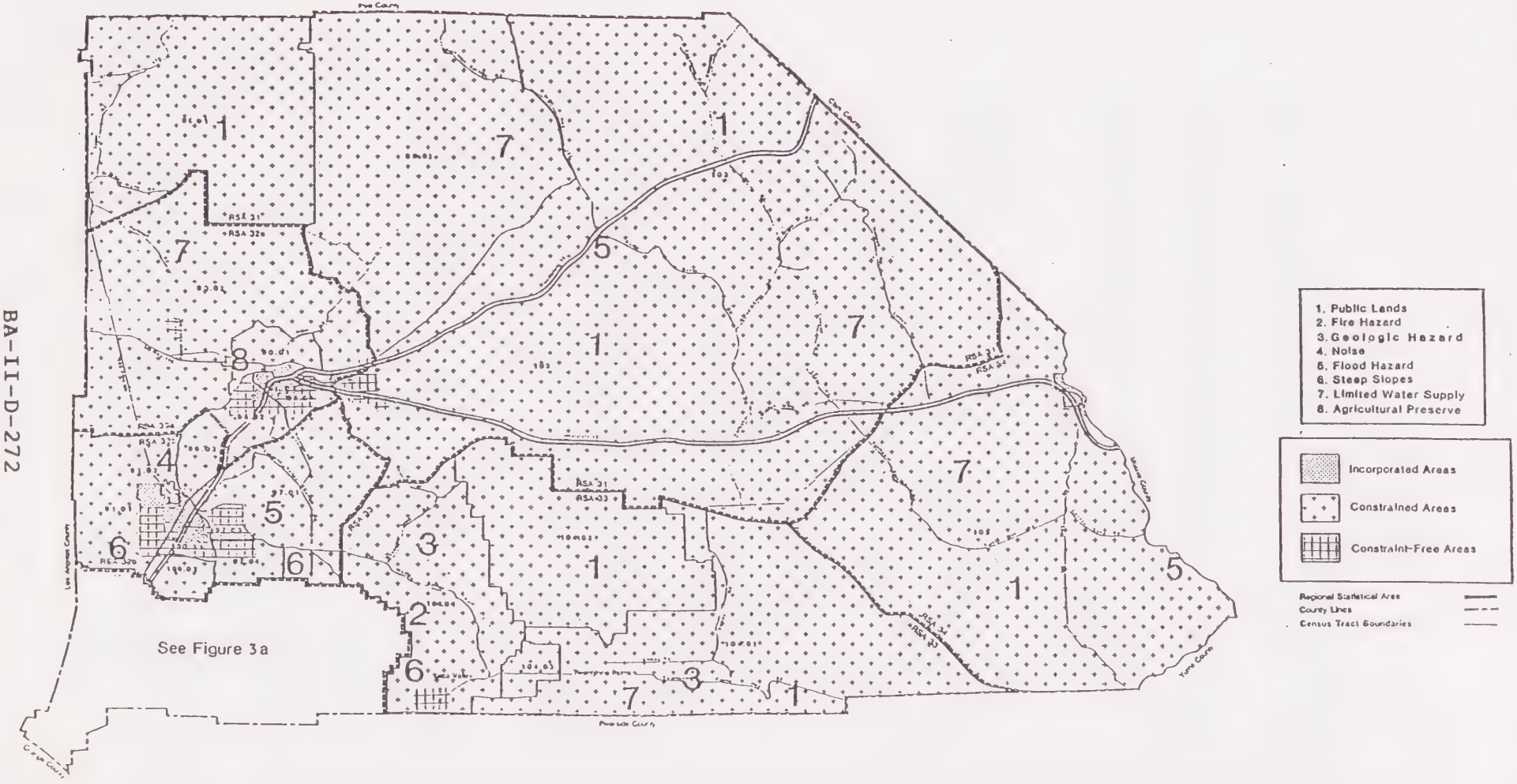
Figure 4a



BA-II-D-271

Development Constraints

Figure 4b



Development Constraints

D. INTERGOVERNMENTAL COORDINATION

Land Use Planning in the Sphere of Influence Areas

In the last few years, the cities have been critical of some of the land use decisions made by the County in the sphere of influence areas. The cities' major concerns are that:

1. Some of the land uses proposed by the County for the SOI areas are not compatible, and are not logical extensions of the adjacent land uses within the cities' boundaries.

2. Development standards of the County are relatively lax depreciating the quality of the permitted development and adversely impacting the neighborhoods including adjacent areas within the cities.

3. The review procedures employed by the County do not include urban design and architectural design considerations which are used by many cities.

Section 65300 of the California Government Code places a dual mandate for both cities and counties relating to land included within a sphere of influence. The County currently refers all proposed projects within a sphere to the appropriate city for review and comment.

Recently the County adopted a new ordinance (the Land Use Compatibility Overlay District LC1 and LC2) to ensure better coordination between the cities and the County when establishing development standards that will be used to evaluate proposed projects within the sphere. The ordinance also requires a more stringent review procedure (site approval) for all development proposals. Joint studies are currently underway between the County and the cities of Fontana and Montclair respectively, regarding future planning efforts within the sphere of influence areas of the two cities. The Land Use Compatibility Overlay (LC) may be applied to these two areas.

Other alternatives being considered to address the planning issues within the SOI areas include:

1. County adoption of major city planning policies and development standards including conversion of city plans and prezoning into equivalent County designations and/or verbatim or reference adoption of the City General Plans, prezoning and development standards for the spheres. This alternative may provide consistency of land use and encourage annexations but also has the potential to complicate the development review procedures; County Staff may have to become familiar

with the development standards and planning policies of the twenty incorporated cities within the County, and this may prove to be cumbersome and time-consuming for applicants as well as staff.

2. Preparation of joint City-County plans, Zoning ordinances and standards (e.g. East Valley Corridor Specific Plan). This alternative may provide comprehensive land use planning which may even include a fiscal impact component, but it demands a tremendous amount of staff time and requires major financial commitment. It may take the next twenty years to prepare individual specific plans for each of the spheres of influence areas in the County.

3. Forced annexation by limiting or prohibiting urban development in spheres of influence areas pending annexation, or approval and service provision by the City. This alternative may not be acceptable to the electorate who reside in the SOI areas.

4. County contracts with city for planning, and building and safety services through a Joint Powers Agreement (JPA). This alternative involves the establishment of development standards that are acceptable to the cities, reconciliation of incompatible land use designations, and transfer of review of all proposed projects within the SOI areas to the cities. Furthermore, the County must enter joint powers agreements with each of the twenty-one cities in the County. Transferring control of land uses within SOI areas to the cities may generally be acceptable to the cities, and may, in fact encourage annexation, but this alternative leaves some questions unanswered. These unanswered questions include:

    - the legality of joint powers agreements between a county and a city regarding land use and development within SOI areas;
    - the legality of delegating certain powers especially legislative powers;
    - compensation for city planning departments for work that should have been done by the County staff; development fee that should be charged the applicant - either the City's or the County's;
    - and representation of County residents on the city's planning commission, and the implications of increasing commission membership especially for chartered cities.

All these questions need to be addressed in the joint powers agreement signed by the City and the County.

5. County to sponsor State legislation to establish definitive State guidelines regarding land use planning and development issues within the SOI areas. If such legislation is introduced and if it is passed, the cities and counties of this state will have uniform guidelines that will direct all planning efforts within their spheres.

Regional, State and Federal Agencies

There are many Federal, State and regional agencies whose actions may affect land use planning and development in San Bernardino County. Also, the County is one of the six counties that make up the Southern California Association of Governments (SCAG) and is also actively involved in policy formulation for the San Bernardino Associated Government (SANBAG) whose primary responsibility is to ensure continuity and coordination of planning activities of the government agencies in the County. SANBAG also acts as the County's Transportation Commission whose policies and programs have far reaching land use implications especially in relation to the disaggregation of future growth.

Also, the County monitors the activities of the Bureau of Land Management (BLM), the National Forest, and the Military who together own over 70 percent of the total land area within the County. When public land (for example, BLM land) is exchanged and transferred into private ownership, the County has to be notified to ensure that appropriate regulations will be imposed on the newly created private land. The County refers development proposals to the State Department of Transportation (Cal-Trans), Department of Fish and Game, the Department of Water Resources (DWR) and other appropriate regional, State and Federal agencies when appropriate. Also, a close working relationship is maintained with the Southern California Air Quality Management District whose responsibility is to ensure that local agencies land use policies are aligned with the goal of meeting the Air Quality standards established by the Environmental Protection Agency.

III. THE PROPOSED SYSTEM

A. The General Plan Text

The proposed General Plan is organized around issues that address the seven State mandated elements, plus additional optional issues that are relevant. (Government Code Section 65302). The section on land use issues contains policies and procedures that apply countywide and explains the criteria used in applying land use categories. A major goal of the proposed Land Use Element is to achieve internal consistency among the various elements and

issues addressed in the proposed plan. The proposed Land Use Element does not supercede the other General Plan Elements but rather, it complements them by incorporating and implementing their land use concerns and recommendations.

All lands not within jurisdictional control of the County shall be coded on the Official Land Use maps to reflect the agencies that control them. This includes cities, Indian Reservations and public owned lands such as BLM, Military, National Park and Forest etc. Although the land use plans of the incorporated cities shall not be included as part of the proposed general plan land use mapping systems, this exclusion does not negate the need for continuity between city and county planning. The County shall continue to make reference to city plans when appropriate to reinforce the policy of working with cities to achieve common land use goals. That policy recognizes that land use problems and opportunities have effects which do not stop at political boundaries, and that such issues can be adequately resolved only through cooperation between affected agencies. While a city general plan may include lands beyond city limits, the County Land Use Element will be the policy administered by the County for development in the unincorporated city sphere areas. The City Plans prevail within city limits. Also, growth management policies that are under consideration by the Board of Supervisors will be incorporated wherever possible into the proposed General Plan Update.

B. Official Land Use District Map

The proposed General Plan consolidates the zoning and the General Plan maps into one Official Land Use District Map. One intent of this is to eliminate potential in consistencies between General Plan and Zoning. A one map system however calls for a more specific boundary definition than that required for a general plan that is accompanied by zoning. Therefore, the proposed General Plan map is parcel specific.

The purpose, locationals criteria, population density and building intensity standards for each of the fourteen districts should be established. The uses that are permitted in each district, the applicable review procedures, and the site specific development standards shall be discussed in detail in the Development Code.

C. Status of Existing and Future Community Plans Study Areas

The County adopted 15 Community/Specific Plans in the last decade. However, there are over sixty (60) identified communities or sphere of influence areas for which community plans could be prepared and adopted. All land use policies and standards that are generic (common) to all the existing community plans will be incorporated into Section II of the proposed General Plan. Unique policies and development standards shall be incorporated into Section III of the General Plan and Division 6 of the Development

Code respectively. The intent of individual community plans may still be created by combining the countywide policies and standards with specific community modifiers and standards which are generally more directive and restrictive than the countywide policies and standards.

The Specific Plan texts for Chino Hills, Agua Mansa, and East Valley (I-10) Corridor will be adopted as part of the General Plan. The policies and standards therein shall be implemented in the applicable communities in addition to applicable countywide policies and standards.

D. Growth Management

The County's major land use issues and concerns revolve around the capability of its natural and man-made resources to support and sustain the predicted future growth of the County. Draft Projections show that the County's population is expected to double within the next twenty (20) years and while this predicted growth offers some opportunities, it can, if not managed properly, be accompanied by some undesirable side effects.

The role of the General Plan is to guide the future development of the County. In this context, all growth management policies and strategies could be incorporated into and adopted as part of the General Plan. There are practical as well as legal reasons why growth management measures should be tied directly to the General Plan. As a practical matter, a growth management program will be more effective and, perhaps, subject to fewer legal challenges if it is linked directly to the General Plan rather than adopted independently. First, all regulations based on police power and used in a growth management system must promote the general welfare of the Community. The General Plan represents the most comprehensive statement of the Community's general welfare as it relates to environmental and land use matters. Second, the General Plan contains projections of the future population which form the basis for proposed land uses and facilities. For growth management systems seeking to manage population either by setting an absolute limit on growth or by using an annual growth rate, population projections developed in the context of the General Plan can give legitimacy to specific measures that regulate growth.

Third, the General Plan is a forum for balancing competing interests and objectives in deciding the future of the community. The community's desire to regulate growth may conflict with its obligation to provide adequate housing opportunities. The General Plan is a most appropriate mechanism for making the necessary tradeoffs between these two competing objectives. Fourth, various provisions of State law require local governments to implement the General Plan in a consistent manner. The requirements calling for consistency with the General Plan are

clear for zoning and subdivision regulations and capital improvements, all of which are commonly used growth management techniques. The County's Growth Management Task force is currently considering ten short term (six months) and five long term action items that are designed to manage the future growth in the County. Five of the short term items can be incorporated directly into the Land Use strategy of the General Plan and implemented by the proposed land use system. These five action items are discussed below:

1. **Establishing Urban Infill Incentives whereby the County provides incentives to the builder/developer to encourage development on vacant skipped-over parcels of land in otherwise built up areas.**

   Infill development can be a means of protecting and enhancing older neighborhoods. It is also a way of maximizing the utilization of existing infrastructure facilities and of saving energy; the assumptions being that urban services are readily available in infill areas and in addition, these areas are in close proximity of places of employment. If implemented, infill development can be an effective method of preserving land, water and other natural and man-made resources.

   However, despite the widespread public interest in infill development, some cautions should be cited about specific expectations. Using land that already has public services can reduce government capital expenditures. But whether the existing infrastructure is a real asset that can be used to attract developers to infill locations depends on how well it has been maintained and whether it meets today's design standards. Many older neighborhoods will need to upgrade their infrastructure facilities whether or not they infill vacant parcels. In an era of fiscal restraints it will be difficult for the County to raise the funds needed to continue current maintenance levels and correct past problems. New infill projects will however help to distribute the cost burden among a larger number of users.

   Also, the cost of land may be relatively higher in infill areas than in the outlying suburbs because of perceptions of stability of these areas and their proximity to jobs, schools, shopping, and major transportation routes. Builders and realtors interviewed in a study conducted by the Planning Department of the City of Omaha and other related research cite high land prices as a major deterrent to the financial feasibility of infill construction when compared with fringe development. This high cost of infill land may be offset if the County allows higher density development than is typically permitted at the urban fringe. The County may also reduce processing time for infill projects.

Certain policies of some of the incorporated cities in the County also discourage developers who may be interested in infill development. For example, the City of San Bernardino does not extend services to any new development unless it is annexed to the City. For fear that they will become liable for some development impact fees and tougher development standards, developers are reluctant to annex to the City. However, development in the outlying areas also translates to considerable capital expenditure on the part of the developer since he is expected to provide the required infrastructure facilities and public services. It may actually be more beneficial for a developer to develop over skipped-over parcels and take advantage of the existing infrastructure facilities and public services, and other incentives granted by the County than to develop in the outlying areas.

2. **Adopting Sphere of Influence (SOI) policies requiring city standards, encouraging incorporations and annexations.**

This strategy is designed to encourage areas within the spheres of influence to annex to the City prior to development, the assumption being that the City can better provide needed urban services to the new development. Since most SOI areas are largely in urban areas and since the County wants to encourage a more efficient land use pattern, most of future development will probably be directed to the SOI areas. A list of planning alternatives that can be employed in SOI areas are presented on page 62 of this report. (It is noteworthy that the County of Ventura does not allow urban development in the unincorporated portion of the County prior to annexation to any of the ten cities in the County.)

3. **Establishing Urban Service Boundaries.**

One of the main intents of establishing urban service boundaries is to ensure that future development is coordinated and correlated with infrastructure facilities and public services. The Planned Service Level (described earlier) as proposed here, is designed to ensure that infrastructure facilities and public services keep pace with future development. Infrastructure facilities required in the urban areas where higher density and intensity development is expected at buildout are significantly more than those required in rural or remote areas where ultimate buildout density is expected to be very low or where development is verboten. It is important, however, that the County considers the policy implications of establishing urban service boundaries especially in terms of its effects on regional land market.

4. **Making future development contingent on availability of infrastructure facilities and needed services.**

The planned ultimate future development of an area is the predominant factor considered before a PSL is assigned to that area. For example, because higher intensity development is expected in the urban areas, PSL 1 and PSL 2 are applied to these areas, while PSL 5 and PSL 6 are applied to rural and remote areas because the ultimate development planned for those areas are very limited. Since all future development have to provide the infrastructure facilities and public services required for the area prior to development, the County is assured that future growth will not become a fiscal burden.

5. **Establishing development standards for urban/rural areas to ensure quality of life.**

The Official Land Use Districts (OLUD) are designed to control the location and timing of future development. The performance standards established to regulate the uses that are permitted in each of the planning areas are designed to protect the environment and adjacent land uses while affording land owners maximum flexibility as to how to use their property. Protection of prime agricultural land is promoted through Williamson Act and additional requirements are built into the land use system to further ensure protection of prime agriculture land from urban encroachment. The prohibition of development in the Floodway (FW) district, and further restrictions that are imposed in the form of overlays and modifiers (that generally require special development standards in environmental sensitive areas) are some of the features that are built into the proposed system to protect and preserve the County's natural resources.

The County may wish to establish standards that can be used to determine an acceptable quality of life for its residents because the concept of preserving, or enhancing "quality of life" is nebulous without such standards. Quality of life is a relative concept highly dependent on individual values and beliefs. Its interpretation is subjective because it is not readily quantifiable. However, there are a list of factors including level of traffic congestion, availability of water supply, Sheriff and fire services, parks and open space needs, building intensity and population density that can be considered to establish a quality of life index that is deemed adequate for County residents.

Action items 3, 4, and 5 are all interrelated and implementation could be combined. As mentioned earlier, most of the future growth will be directed to the urban areas where infrastructure facilities and needed public

services are readily available. Future development in all areas is contingent on the provision of the infrastructure facilities and services required for the area. This ensures the adequacy of needed services since they are developed as needed.

E. Job/Housing Balance

One of the major challenges facing the County in the future is how to bring about a balance between housing and jobs in the County. As mentioned earlier, there is an apparent disproportion between jobs and housing in the County; the number of jobs available are significantly less than the number of people who are eligible to work. Many County residents, therefore, have to look to other neighboring counties for places of employment and this greatly strains the existing transportation infrastructure facilities and also worsens the region's air quality.

"Jobs/housing balance" is based on the premise that commuting, the overall number of vehicle trips, and the resultant vehicle miles traveled, can be reduced when sufficient jobs are available locally to balance the employment demands of the community and when commercial services are convenient to residential areas. Lengthening commute times and growing congestion has brought this idea to the fore in some communities. The County of Ventura and the Southern California Association of Government (SCAG), for example, have both embraced jobs/housing balance as a weapon in the fight to maintain air quality.

SCAG identified a list of alternative strategies that can be employed to balance jobs and housing (please see page 4 of Alternative E). Of these strategies, three can be incorporated into the proposed land use system. These are:

1. Enterprise Zones.
2. Local police powers (several variations) and
3. Location of New Regional Public Facilities.

Agua Mansa Specific plan is based on the concept of the Enterprise Zone and the County may wish to expand this concept to other identified areas in the County. Also, the County may wish to provide incentives to encourage commercial and industrial developments and discourage residential type development. Such incentives may include increasing land areas designated for commercial and industrial uses and reducing land area for residential uses. But merely designating a piece of property for a particular use is not a guarantee that the property will ever be developed for that use. A more efficacious strategy may involve a combination of land use regulatory system and some forms of exactions and/or development impact fees which will be levied on residential developments only. Revenue generated may be used to provide needed infrastructure for commercial and

industrial developments. The linkage of residential development to office development is well documented in recent planning literature but there has been very little written on linking industrial and commercial developments to residential development. (Please refer to 1987 Zoning and Planning Law Handbook pages 275 - 319, and The Journal of American Planning Association (APA) Winter and Spring 1988.)

Achieving a jobs/housing balance requires controlling the location, intensity, and nature of jobs and housing in order to encourage a reduction in vehicle trips and miles traveled and a corresponding increase in the use of mass transit and alternative transportation methods such as bicycles, carpools, and walking. Planning for a jobs/housing balance requires in-depth analyses of employment potential (existing and projected), housing demand (by income group and corrected for regional housing opportunities), new housing production, and the relationship between employment opportunities and housing availability. Other factors such as housing cost and transportation systems must also be evaluated. Strategies include locating higher density housing near employment centers, promoting infill development, actively recruiting businesses that will utilize the local workforce, and providing affordable housing opportunities within the Community. Jobs-housing provisions most directly affect the land use, circulation, and housing elements.

Policies need to be established to coordinate future population increase with employment opportunities.

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